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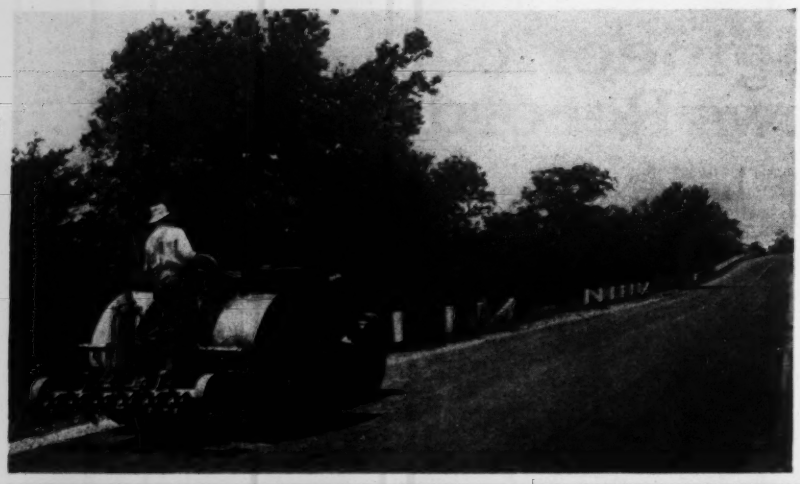

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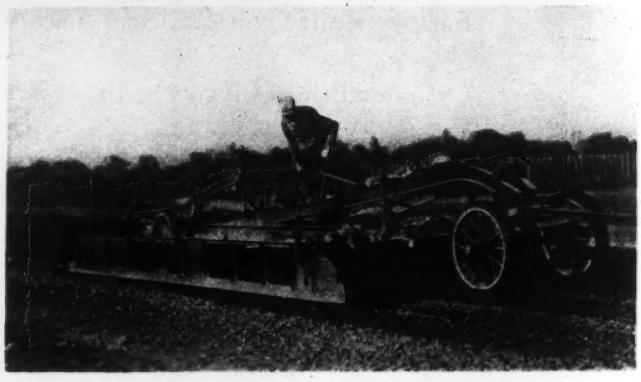

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Factory of 19 Stories Over Railroad Yard

In Starrett-Lehigh building in New York City each tenant fronts on a "vertical street" containing all utilities and truck elevators—Building is a cantilever-wall concrete structure on three stories of steel with truss and girder framing

ONE OF THE most important industrial buildings completed in the country during 1931 was the Starrett-Lehigh manufacturing and distribution center in New York City. Built over the yards of the Lehigh Valley Railroad and occupying an entire city block with west frontage on the piers along the Hudson River, it is well situated for domestic or export distribution service. Motor-truck distribution is particularly provided for by large elevators that take the trucks to loading platforms at any floor. A total of 1,800,000 sq.ft. of floor space is available for manufacturing facilities. The building varies from nine to nineteen stories. Ceiling heights are 12 ft. 8 in., and column spacing is about 21 ft. As much as 652 ft. of straightaway for line production is available on any of the lower six floors of the building.

The building is unique in the extent to which its basic plan was developed to make every floor as convenient and economically usable in every respect as a first floor. Briefly, this was accomplished by grouping all utility supply facilities—water, steam, electric current, gas and sewage—and all transportation facilities in a single small area and giving every tenant, on any floor, frontage on this area, which is in truth a vertical street. The first building to include the vertical street idea is said to have been the 900,000-sq.ft. New York Dock Trade Facilities building in Brooklyn built four years ago.

In addition to its functional features, the Starrett-Lehigh building involves several unusual structural layouts. Because of the railroad yard on the ground floor, involving several curves and cross-overs, wide-spaced columns are necessary in the first and second floors of the building, requiring heavy girders and trusses to establish a uniform column spacing above. In effect, the building is a concrete flat-slab structure resting on a structural-steel base three stories high above the street. An exception is that steel framing is utilized exclusively for the elevator shaft and service portion of the building, located in the center of the south side. The most distinctive structural feature of

Fig. 1—Designed to furnish many small manufacturers with single-story factories fronting on a "vertical street," the Starrett-Lehigh building is a notable addition to American industrial buildings.

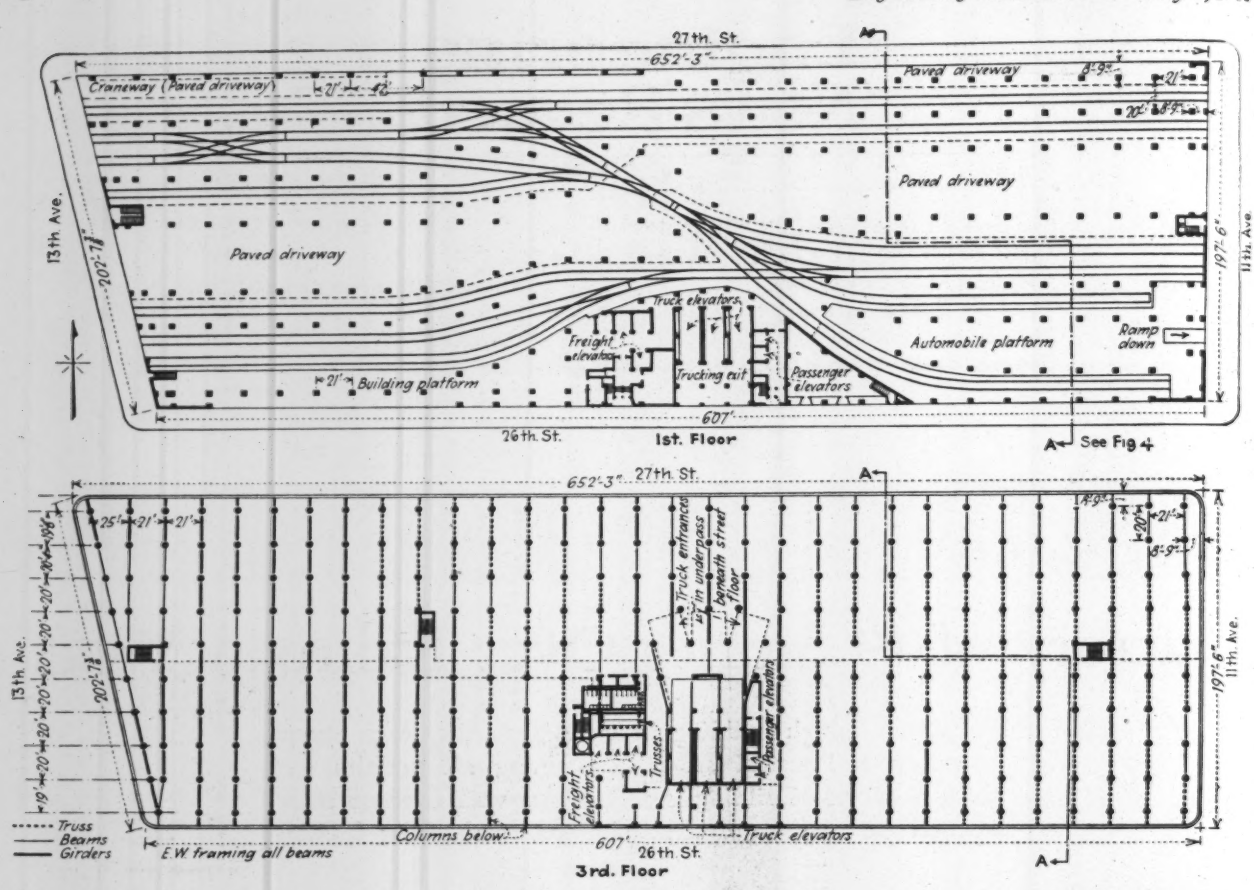


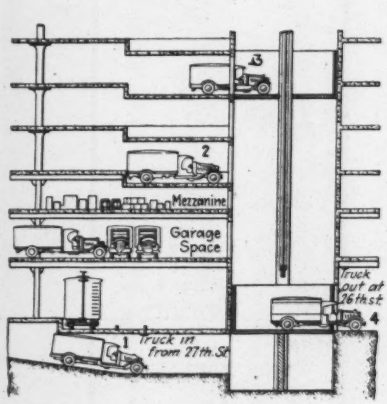
Fig. 2—In the Starrett-Lehigh building a reinforced-concrete flat-slab structure is carried on three stories of structural steel. The first-floor plan shows the steel column locations required by railroad clearances, while the columns in the third-floor plan are typical of those obtaining in all the upper stories. The many girders and trusses in the latter plan are a notable characteristic of the building.

the building is the cantilever-wall construction, by which the "wall" columns on all floors are set back 8 ft. 9 in. from the windows, which form continuous bands around the building except for an interruption in the elevator shaft portion.

The plan upon which the Starrett-Lehigh building was built is, according to the architects, based on a definite train of reasoning involving the following factors and assumptions: about 97 per cent of the manufacturing companies in this country employ less than 250 men and require less than 100,000 sq.ft. of space. Few of them are able and almost none is justified in making any capital investment in building or real estate, for in the first place their working capital is relatively small, and in the second place new inventions or changes in industrial methods may destroy not only their business but the value of any building built for a special purpose. The majority of these businesses should be located in a city where labor supply is plentiful and where transportation and distribution facilities as well as power and other utilities are adequate and already available.

Having fixed the location of these businesses in cities and determined upon the purchase of space and power on a rental basis, the plan of the manufacturing plant itself could be considered. It was assumed as ideal that each company have its own building, that this be a one-story structure, that it front on a paved street connected with convenient railroad and ship terminals, that this street be provided with transit facilities and contain all public-utility and municipal services, and finally that the building be designed to accommodate off-street truck delivery and shipping facilities.

Fig. 3—Cross-section of truck elevator, showing building entrance and exit facilities and loading docks on the various upper floors.



Such an ideal layout, involving rows of one-story single-tenant factories on each side of a fully equipped street, would not be possible in a city where high land values predominate. But by rotating this layout 90 deg.—standing the street on end and placing the one-story single-tenant factories one on top of the other—the same efficiency could be obtained on a relatively small plot of land, vertical transportation being furnished by elevators that would deliver trucks to the tenants' doors. Such a vertical street building, while duplicating the facilities offered by a horizontal street layout of single-occupancy buildings, offers the added advantage that the tenant rents only usable space, all service space, including toilets, stairs and elevators, being in the vertical street whose operation is paid for on a pro-rata basis.

As previously stated, a building following these principles was built in Brooklyn in 1928. In the Starrett-Lehigh building the plan was used for the second time but on a much larger scale.

The railroad yard occupying the

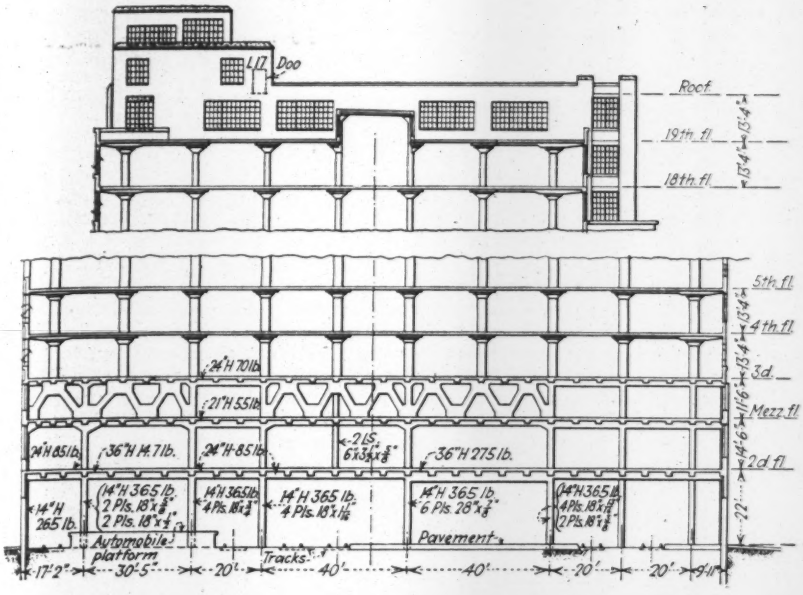
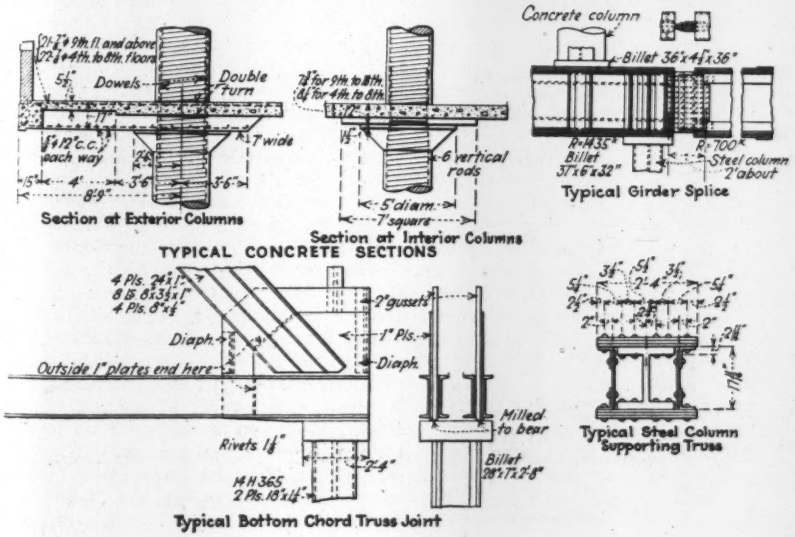


Fig. 4—This section, taken through the Starrett-Lehigh building, as shown on Fig. 2, gives the characteristic construction consisting of a reinforced-concrete building resting on three stories of structural steel.

Fig. 5—Cantilever walls and continuous bands of windows characterize the upper floors, where uniform column spacing of about 21 ft. is provided.

Fig. 6—Among the structural details of the building the trusses are notable in that the gusset plates are inserted between the double-channel chord members and milled to bear at the column supports as well as at the top-chord points where steel billets carry the reinforced-concrete columns. The cantilever floor at the exterior columns in the reinforced-concrete portion is a distinctive characteristic of the building design.



building site was originally a series of ladder tracks laid out to accommodate horse-drawn vehicles. The first step was to redesign this yard on a modern, efficient basis with a driveway down the center, outside driveways along either side and platforms for automobile delivery and for receipt and dispatch of l.c.l. freight. Building column locations were entirely ignored in this first study. Subsequently it was necessary to shift some of the tracks slightly, but in general the building columns were accommodated to the track layout and to the difficult foundation conditions described fully in the article immediately following. The location of the vertical street service area on one side of the building instead of at the center was a direct result of track and platform layouts in the freight yard.

Motor trucks enter the building on the 27th St. side, cross the railroad tracks through an underpass and move into one of the three 15-ton elevators that take them to the desired floor. There they back into pits, some of which are of nine-truck capacity, and unload or load, with truck bodies at floor level. Descending, the trucks emerge into 26th St. without having turned around. By this method goods are delivered on any particular floor without extra handling. So far as traffic facilities are concerned every floor is a first floor.

Railway freight, either in carload or less than carload lots, is received on the platform adjacent to the elevators. Electric trucks enter the cars and move, via a small elevator, directly to the tenant's floor. A side door is also provided in one of the truck elevators opening onto this platform, so that the truck elevators may be utilized for heavy rail shipments.

Of the 15,000 tons of structural steel in the building, almost two-thirds was used in the first three floors. The re-

mainder occurred in the elevator and service area and in concrete columns as cores that extended generally to the fifth or sixth floors but in some cases were not stopped off until the tenth floor was reached. Above the steel-cored concrete columns a spiral reinforcement was provided in columns of a maximum outside diameter of 36 in. Some tied columns were also used. In the design a live load of 250 lb. per sq.ft. was provided for on the second floor, 200 lb. on the floors from the second-floor mezzanine to the eighth, inclusive, and 150 lb. above the eighth floor.

The general framing arrangement is given in Fig. 2. The irregular steel column layout shown for the first floor obtains through the second floor (which was planned as a garage, since the wide column spacing would be an advantage for such service), above which, by means of trusses and girders with their tops at the third-floor level, it is changed to the regular 21-ft. square panel arrangement of reinforced-concrete columns and flat slabs shown for floor No. 3.

The height of the trusses, 11 ft. 3 in. c. to c. of chords, was fixed largely by bridge and tunnel headroom clearances on the Lehigh Valley Railroad, over which they were shipped. The lower chords of these trusses were utilized to carry a mezzanine floor, below which the second floor (used for a garage) had a clear height of 12½ ft. Two bays of this second floor are 40 ft. wide. One of these bays spans railway tracks beneath, so that a shallow floor was required for clearance purposes. Accordingly, this bay is carried at the center by a hanger from the trusses above. In the other 40-ft. bay a deeper floor was permissible, and a clear span was provided by means of a heavy 36-in. rolled girder beam. The first story is limited to a minimum height of 18 ft. for railroad clearances. Because the ground slopes from west to east the maximum height is at the east end and amounts to 22 ft.

The trusses occur principally in the east or tall end of the building, while girders are adequate to carry the seven floors that comprise the upper part of the west section. The design of the trusses is in some respects notable. Each truss is composed of two Warren-type trusses, in each of which the chords and diagonals are made up of two channels between which the gusset plates are inserted at the joints, an arrangement that places the rivets in double shear. These gusset plates are milled to bear at the column supports and also at the top chords, where the billets under the reinforced-concrete columns rest. Thus the loads are transferred directly through the gussets with no need for stiffeners. The arrangement by which the gussets are placed between the two channel members permits of considerable latitude in increasing the capacity of the connection by adding additional gusset plates. This expedient was adopted at a number of the connections. Another feature of the trusses is that no lacing bars are used, but instead all members are 50 per cent battened, permitting the elimination of separators.

The heavy girders are of usual built-up construction and occur in pairs. Heavy concentrations of coverplates are necessary under the columns that are carried, and stiffener angles 6x4x½ in. are required. Some of the girders are as much as 65 ft. long and continuous over three columns. Splices are made as close to the center column as possible without encroaching upon it. Only the web is spliced, the flanges being discontinued.

Column sections in the lower-story steel portion are 14-in. H-section with coverplates and angles as required. In the elevator section structural-steel framing extends to the top of the building; and although it is somewhat complicated, it is notable only in the method selected for carrying the elevator guide-rails. Instead of carrying them on tall unsupported columns between the shafts, beams were installed at every floor level, and the guides fastened to struts installed vertically between the beams.

Throughout the major portion of the building in which reinforced concrete is used a uniform design was utilized. This consists of round columns with 5-ft. conical capitals and flat slabs with drop panels. Slabs are 8¼ in. thick to the eighth floor and 7¾ in. thick above that level. Drop panels vary in thickness from 3¾ to 4¼ in. A 2-in. minimum incasement is used around the spiral reinforcement of all columns. The spiral reinforcement is of cold-drawn wire, while intermediate-grade steel rods are used for vertical reinforcement. The concrete mix was 1 : 1½ : 3 for columns and 1 : 2 : 4 for the slabs, with coarse aggregate from ¼ to 1 in. in size. At the points where columns change from steel core to rod and spiral reinforcing, steel billets are utilized, generally 22x5½ in. by 2 ft. 4 in. in size.

At the walls where the floor slabs were continued 8 ft. 9 in. beyond the supporting columns, they were made 17 in. thick, this thickness being carried back 3½ ft. beyond the column for the width of the dropped panel cantilever. Reinforcement in this area consists of ⅝-in.-diameter rods both ways in the bottom and ⅞-in. rods longitudinally in the top. In design the cantilever effect of the flat slabs was found to be negligible, and all bending was taken care of in the columns. Subsequent studies have indicated that a cantilever 10 ft. long represents about the longest that can be used, without introducing a heavy anchor beam behind the column. Long cantilevers also tend to vibrate under machinery loads, which may break the window glass.

Expansion in the building is concentrated at the third points, the reinforced-concrete floors being broken entirely across the building at these locations.

The Starrett-Lehigh building was designed for the Starrett Investing Corp. by R. G. and W. M. Cory, architects and engineers. Yasuo Matsui was consulting architect, and Purdy & Henderson were consulting engineers for both superstructure and foundations. Starrett Bros. & Eken, Inc., was the general contractor.

Water-Power Resources on Snake River

The canyon of the Snake River between Jackson Hole and Alpine, Wyo., has valuable power and storage possibilities and is also the route of a proposed year-round road into Jackson Hole from the south and west. In order to determine the possible conflict between the use of the canyon as a highway route and the use for power and storage, the United States Geological Survey, Department of the Interior, in 1931 made a survey of the river and of the possible dam sites.

A manuscript report just released by the Interior Department describes two power sites and one combination power and storage site on this stretch of the river. At the upper site it would be possible to store 610,000 acre-ft. with a dam 210 ft. high. Of this storage 470,000 acre-ft. would be available in the upper 70 ft. of the site, and the use of this water through an average head of 434 ft. at the three sites would increase the potential power available for 90 per cent of the time from 47,000 to 69,000 hp., and the power for 50 per cent of the time from 72,000 to 90,000 hp.

The report, which was prepared in connection with the classification of power-site lands by the Geological Survey, also includes a recommendation defining a highway location that would cause a minimum of interference with the power and storage potentialities. The report was prepared by L. L. Bryan, hydraulic engineer, and contains a geologic description of the canyon and dam sites by G. R. Mansfield, geologist. It is open to public inspection at the main office of the Geological Survey in Washington, D. C., and at the district offices of the Survey at the federal buildings in Boise and Idaho Falls, Idaho. It includes thirty pages of text, five sheets of maps showing plan and profile of the Snake River between Pine Creek, Idaho and Horse Creek, Wyo., on a scale of 2 in. to the mile, with five dam sites on a scale of 400 ft. to the inch, numerous tables, diagrams, photographs and a list of benchmarks.

Extra Long Cylinder Piles Carry Column Loads to Rock

Steel cylinders driven from 60 to 140 ft. to rock and blown out by compressed air form foundations of Starrett-Lehigh building in New York—Tests show settlement of $\frac{1}{8}$ in. under $1\frac{1}{2}$ times the designed load

By W. T. McIntosh
Engineer, Spencer White & Prentis, Inc., New York, N. Y.

ONE OF the problems of design of the Starrett-Lehigh building described in the preceding article was the type of foundation to be used. The building provides for live loads of 150 to 250 lb. per sq.ft. of floor area, resulting in a total dead and live load of about 260,000 tons for the building. Wide column spacings and the bridging of loads over the railroad tracks on the first floor produce individual column loads in excess of 2,000 tons. These are greater than in an office building 40 stories high.

Ground conditions

Borings disclosed rock, at the east end of the site, at a depth of 60 ft. below the street, dipping toward the west. At the middle of the lot the rock was 80 ft. below the street, thence dipping more sharply to the west. Throughout the western third of the site the rock depth ranged from 95 to 140 ft. The material overlaying the rock was gray river mud or mixtures of gray river mud and fine sand, except for a few feet of miscellaneous fill at the top and a shallow layer of fine gray sand immediately over the rock. The river mud was totally incapable of carrying the weight of the proposed building on spread footings or a mat. Caisson foundations were considered, but, because it would have been necessary to install them by the pneumatic method, their cost was found to be prohibitive in view of the rents obtainable for the proposed space.

The proximity to the Hudson River assured a permanent groundwater level only about 6 ft. below the street, thus favoring a wood-pile foundation, but it was decided that the settlements to be expected, if wood piles were used, even at 15 tons per pile, were more than should be permitted in a building of the character proposed. The warehouses and other buildings in the neighborhood that had been built on wood piles gave direct evidence of what settlement might be anticipated. One in particular, close by and on the same material, showed very serious damage. Even if the number of wood piles were increased so that the unit load was only 10 tons per pile, the total load over the area of the site would still be more than 2 tons per sq.ft. None of the material above the rock or the shallow layer of fine sand over it was capable of supporting that load, so that driving wood piles, or concrete friction piles, would only transfer the load to material at a lower level, which was as incapable of carrying it as that near the surface.

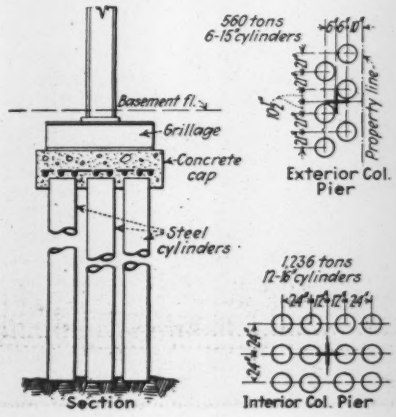
Consideration of all factors led to the conclusion that a foundation of steel-pipe piles to rock was best suited to the conditions.

Pile foundation design

Steel-pipe pile foundations consist of groups of steel cylinders driven with open ends to rock, excavated, cut off at the required grade, filled with concrete and capped with reinforced concrete. A typical pier is shown in Fig. 1. The cylinders are generally from 10 to 18 in. in diameter, with $\frac{3}{8}$- to $\frac{1}{2}$-in. shells. They are of seamless or lap-welded steel tubing, which comes in random lengths, generally from 20 to 30 ft. long. When longer piles are required, two or more lengths are joined together with internal or external sleeve couplings. Ordinarily these sleeves are a tight driving fit, and always the lengths of tubing below and above the sleeve come to a firm even bearing on a shoulder of the coupling.

In fixing the carrying capacity of steel-pipe piles on rock the present New York City building code conservatively allows 7,500 lb. per sq.in. on the area of the steel shell, after deducting the outside $\frac{1}{8}$ in. of shell for possible rusting, and 500 lb. per sq.in. on the area of concrete inside the shell. The resulting capacities range from 57.6 tons for a $10\frac{3}{4}$-in. outside diameter pile, $\frac{3}{8}$ in. thick, to 144.6 tons for an 18-in. outside diameter pile, $\frac{1}{2}$ in. thick. When the code was written, 12-in. diameter cylinders were generally used, 15-in. were the largest, and piles longer than 40 to 50 ft. were not envisioned. The piles were regarded as unsupported columns, despite the fact that considerable lateral support is actually provided by the surrounding ground, however poor the material; the length of steel piles was limited to 40 diameters, and the number of sleeve joints to one.

Fig. 1—Typical steel-pipe pile piers, in which 15- and 16-in. steel cylinders are used.



On the western end of the Starrett-Lehigh site piles driven to rock would run up to 130 ft. in length, over 60 diameters for a 24-in. pile or 80 diameters for an 18-in. pile, and would require three or four sleeves if random-length pipe were used. It was agreed with the building department of the city that, in view of the fact that the 40-diameter limit was purely arbitrary and unsupported by test or experience, it should not prevent the use of steel-pipe piles, which were clearly the economical foundation for this operation. It was decided that, with special treatment to reinforce the cylinders at the sleeve couplings and careful testing and filling of the shells, steel pipes could be relied upon to provide a perfectly safe foundation, free from settlement, despite the depth to rock. As a measure of conservatism, however, the allowable loading of piles exceeding 40 diameters in length was decreased 10 per cent.

In the new building code (completed but not yet adopted) the 40-diameter rule is modified, being applied only to the upper 60 ft. of the pipe. Pile lengths and number of sleeves are unlimited, but provision is made for discounting the allowable load when the length exceeds 40 diameters. The base loadings allowed are practically the same as in the old code.

In order to maintain uninterrupted service in the Lehigh Valley yard on the site, the building was erected in two sections. The first section covered the easterly two-thirds of the yard. The foundations for the two sections were installed under separate contracts by different contractors.

The original plan for the building was for a uniform height of fifteen stories over the entire site. However, when the borings disclosed that in the easterly two-thirds of the site the rock averaged 75 ft. deep, while in the westerly third it averaged 125 ft., this plan was changed. The height of the easterly part of the building was increased to nineteen stories, and the westerly was decreased to nine stories, providing essentially the same total floor area. The foundation cost was greatly reduced by so increasing the column loads (and thus the num-

ber of piles required) in the shallow end of the site and by reducing the loads and the number of piles in the deep end.

First-section foundations

Installation of the foundations for the first section was begun in August, 1929. The steel cylinders used were 18 and 24 in. in outside diameter and ⅜ in. thick. To reduce the number of sleeve joints in the piles, ordinary random lengths were electrically welded together. Great difficulty was found, however, in producing welds that would successfully resist the impact of driving, and it was found necessary to modify the practice by reinforcing the welds with external sleeves, electrically welded to the cylinders at considerable cost.

The piles were driven with open ends to reduce to a minimum the resistance to driving and to permit bringing the cylinders to a firm even bearing on the rock. Double-acting steam pile hammers were used, steam being supplied from a central plant of portable locomotive-type boilers. For handling the cylinders and hammers and for other operations two traveling derrick rigs were set up, each rig consisting of four derricks, the usual four-post rigs employed on compressed-air caisson jobs in and around New York. Additional stiff-leg derricks were used as required. Obstructions, such as old rock-filled timber cribs, delayed the driving and compelled the use of additional piles, but these were finally overcome.

The cylinders were excavated by blowing out the material with compressed air, as is the usual practice in steel-pile installation. When completely excavated they were tested to absolute refusal by redriving and were then filled to the required grade with concrete and cut off by oxy-hydrogen torch. As each group of piles was completed, it was capped with reinforced concrete ready to receive its column billet or grillage. Concrete was delivered from a commercial plant in dry-batch mixing trucks, water being added and the mixing done at the job. The foundations for half of section 1 were completed in December, 1930, and for the other half in March, 1931.

Second-section foundations

Work was started on foundations for the second section on Jan. 1, 1931. All the cylinders on this section were 18 in. in outside diameter, a part of them being ¼ in. thick and the others ⅜ in. Tubes of 24-in. diameter were not used because of the resistance that they offered to driving and the difficulties experienced in getting them down to rock on the first section. Further, it was felt that there might be very serious difficulty in blowing out the material in such large cylinders from the depth to which the piles would be driven.

To reinforce the piles at the joints between sections of tubing, heavy cast-steel internal sleeves were designed. These were about three times the length of the sleeves ordinarily used and had outside diameters greater than the inside diameters of the cylinders, with tapers at top and bottom, so that the pipe was actually stretched when it was driven over the sleeves. These long heavy close-fitting sleeves provided rigid couplings.

The piles were driven with 5-ton single-acting steam hammers in pile-driving leads. Each driver was equipped with its own 40-hp. boiler, permitting the maximum independence of movement and assuring an ample supply of high-pressure steam at all times, eliminating the losses that would occur in pipe lines from a central plant, particularly in the winter. Six of these driving rigs were used, as shown in Fig. 2.

Fig. 2—Driving piles, using six piledriving rigs, each complete with 5-ton single-acting steam hammer and 40-hp. boiler.

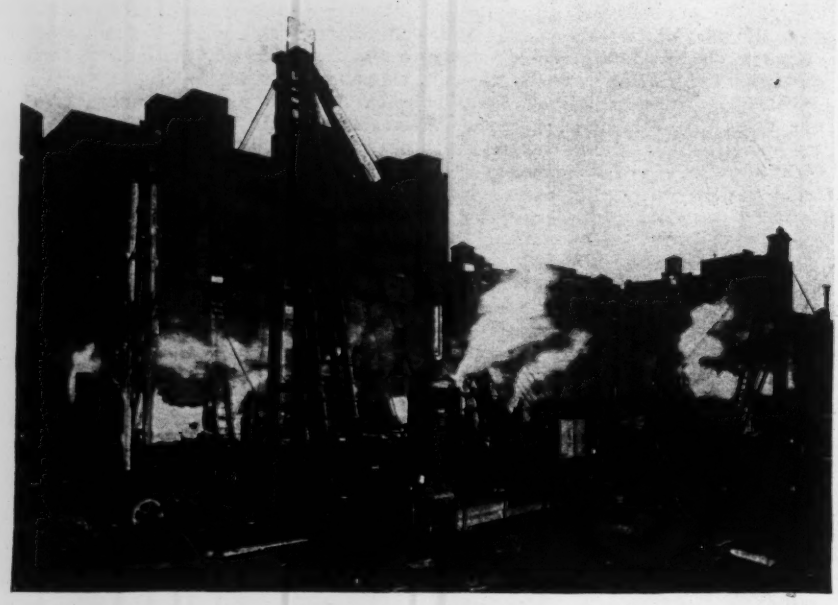


Fig. 3—Blowing out the material from an 18-in. pile 125 ft. deep. The blowpipe and hose can be seen through the shower of sprayed mud.

The single-acting pile hammers proved themselves better suited than double-acting hammers for driving the long heavy cylinders. The lower number of blows per minute was more than offset by the greater impact per blow. A much higher rate of progress was maintained, and the cylinders were driven to greater depth than probably could have been done with the other type of hammer. Experience showed that, even with these hammers, it was extremely difficult to start a pile again if driving were stopped for a few hours before it had reached bottom. Consequently, every pile, once started, was driven home to rock without stopping, except for the few minutes required to add a sleeve and another length of pipe.

The cylinders were driven to absolute refusal under 60 blows per minute of the hammer, giving an indicated carrying capacity for an empty pile greatly in excess of the load assigned for a pile after filling with concrete. The assigned loads were 121 tons for 18-in. piles with ⅜-in. shells and 132 tons for piles with ½-in. shells.

In blowing out the piles a blowpipe with a gooseneck and a hose leading to a reservoir of compressed air was dropped down into each pile, penetrating the material from a few inches to several feet, depending upon the character of the ground. By means of a quick-

opening valve the air at 100 lb. pressure was then literally exploded in the pipe, throwing out a mass of the material, just as a piston would be raised in a cylinder. Water was run into the pile as required, to soften the ground and to form a seal, so that the air would not simply blow out a small hole in the material but would lift a reasonable volume. Blowpipes are usually 2 or 2½ in. in diameter, but on this operation 3-in. pipes were used because of the extreme size and depth of the piles.

Compressed air for blowing was supplied from a central compressor plant, which produced air at 100 lb. pressure and had a total capacity of 4,500 cu.ft. of free air per minute. A very large air receiver was installed, and 6-in. air lines were run throughout the site, so that blowing would not pull down the pressure unduly. In order to lift a plug of mud from the bottom of an 18-in. pile 140 ft. deep, it was necessary to have an ample supply of air at full pressure.

In order to speed up the excavating the piles were first blown to a depth of about 60 ft. and were later blown to the bottom. For the first blowing the blowpipes were handled by gasoline-operated cranes; three cranes with 60-ft. booms were employed. For the final blowing four stiff-leg derricks with 80-ft. booms were installed in addition to the cranes, since the latter could not alone maintain the necessary progress in blowing. For the long piles it was necessary to use 140-ft. blowpipes. These were made up with quick-operating sleeve joints, so that they could be disjointed each time they were moved from one pile to another, without loss of time.

In general, the surface of the rock was so soft that the cylinders could be driven into it somewhat before seating on the hard rock, or it was overlain by a thin layer of firm material that was penetrated by the cylinders, thus forming a seal against the inflow of material when the piles were blown out. In some cases, however, where the rock presented a hard clean surface and local unevenness in the rock surface prevented bringing the cylinders to perfect bearing throughout their entire periphery, it was impossible to blow them out completely. Under the great pressure of 135-ft. head a very small opening was sufficient to permit the fine sand to boil into the bottom of the cylinder, and this could not be removed except by neutralizing the head. Such piles were filled up with water to equalize the pressure, and the sand was jetted out. For this purpose a special jet was constructed, which nearly filled the piles, the purpose being to restrict the area and thereby increase the velocity of the upward stream so that the material would be carried rapidly to the top. Its use proved very successful. The jetting of each pile was continued until the jet reached the rock and the return water ran clear. The pile was then promptly sealed with concrete placed with the bottom-dump bucket that is shown in Fig. 4.

As soon as a pile was blown out to the bottom, it was inspected, sealed with a plug of wet concrete and tested by driving it again to absolute refusal. After final inspection and testing the piles were filled with concrete to cutoff grade. Concrete was bought from a commercial concrete plant in dry-batch mixing trucks and mixed at the job. The concrete was chuted directly from the trucks to the piles, but, in order to do this, it was necessary to build timber runways through the lot for the trucks; the blowing of the piles had, by this time, flooded the lot with mud, so that it was impossible otherwise to get the trucks to the piles. An idea of the extreme size of the piles is gained from the fact that it took 8 cu.yd. of concrete to fill a pile 130 ft. long.

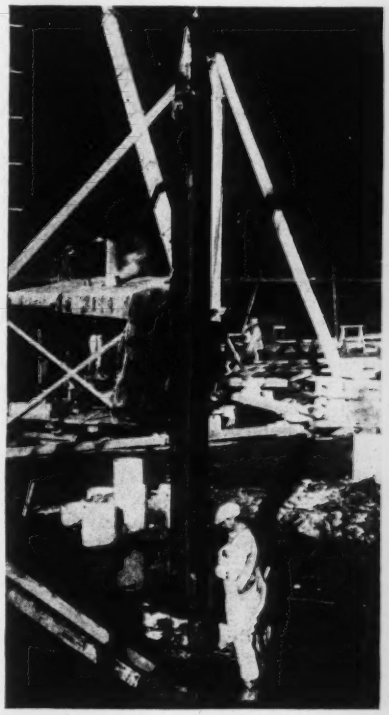


Fig. 4—Specially constructed bottom-dump bucket for concreting piles under water. The bottom door of this bucket is controlled by the closing line of the derrick.

After driving, blowing and concreting the piles, the lot was brought to proper grade and excavations were made for pile caps, elevator pits, etc. The piles were cut off at required elevation, and each group was capped with reinforced concrete brought up to proper elevation for its column billet or grillage. Pit walls, grade beams and other miscellaneous concrete work was then completed.

Foundations for the second section were completed ready for steel erection on March 21, 1931. More than 60,000 lin.ft. of piles was driven, blown, concreted and capped in ten weeks, working five days a week under winter conditions. On several occasions more than a mile of 18-in. tubing was driven in a single eight-hour shift.

Load tests on piles

In order to confirm the carrying capacity assigned to the piles, two series of tests were run. The first was a precise record of settlement of each pile pier under load as the building was being completed. Levels were run at regular intervals from benchmarks outside the structure. On the second section this leveling showed final compressions under the full load of the completed building ranging from ½ to 1 in. These figures agreed very closely with compressions recorded in an exactly similar way in building on deep piers. They were no greater than would have occurred in a foundation of compressed-air caisson piers, costing enormously more, and were very decidedly less than the damaging settlements that would have occurred had the building been built on wood or concrete friction piles.

The second set of tests was conducted after the building was completed. This consisted of testing four individual piles under hydraulic jacking loads. The piles chosen for testing were at the west end of the building and were from 130 to 140 ft. long. Provision for testing had been made when the piles were capped. They had been cut off about 26 in. below normal cutoff, I-beams 24 in. long, with 1-in. plates top and bottom, had been placed on end above them, and combined caps or beams had been cast over them, so that an excess load could be applied to them by borrowing load from adjacent piles for the necessary reaction. Hydraulic jacks were placed on one pile at a time, and that pile was jacked down under the desired test load. In each case, when the jacking test load reached 64 tons, the I-beam was relieved of its load, indicating that each pile had been carrying 64 tons before testing. Increasing the test load to 132 tons, the load that the pile was designed to carry produced ⅛ in. settlement. Increasing the test load to 192 tons, 50 per cent in excess of the designed load, caused an additional settlement of ⅛ in., or a total settlement of ¼ in., no more than would be expected in a caisson foundation. The tests, therefore, demonstrated clearly that the piles were firmly seated and amply capable of carrying much greater loads than they were designed to carry.

The Starrett-Lehigh building was designed by R. G. and W. M. Cory, architects and engineers, with Yasuo Matsui as associate architect and Purdy and Henderson as consulting engineers. It was constructed by Starrett Bros. and Eken, Inc., builders. Foundations for the first section were installed by The Foundation Co., and those for the second section by Spencer, White and Prentis, Inc.

Two-Story Houses, Two Rooms Deep, for Low-Income Group

By John E. Conzelman
Consulting Engineer, Los Angeles, Calif.

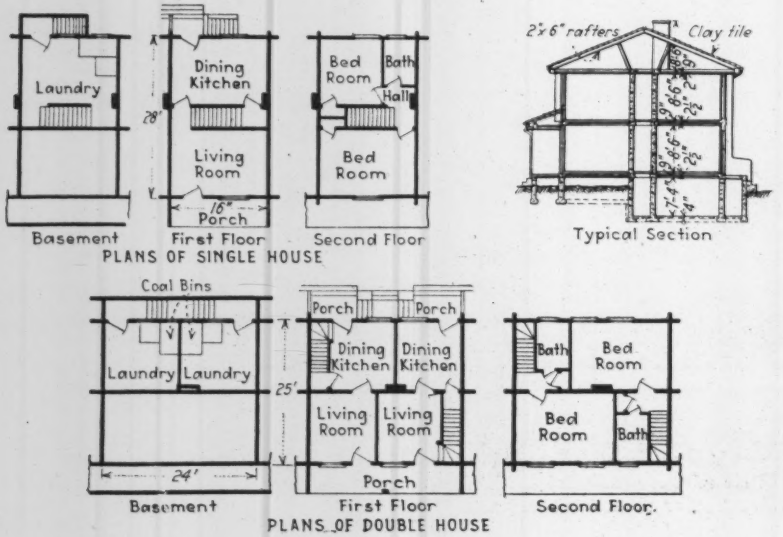
READING between the lines of the reports of the President's Conference on Home Building and Home Ownership and judging from other authorities, the inference is strong that the vast bulk of our working population cannot be housed in proper quarters. The writer believes this not to be the case and that this 40 per cent of the population can be comfortably and decently housed at a cost of less than 20 per cent of its income. The problem is difficult if detached houses are used, because they are expensive in first cost, expensive to heat, and their necessarily small bulk places a limit on architectural expression. The typical mill town of Ohio or Pennsylvania is a striking commentary on the disadvantages of separate dwellings. The problem is relatively more simple if multiple dwellings are adopted, for a saving in both construction costs and land costs may be realized.

Using as a fundamental thesis the proposition that each dwelling must be provided with a front and back yard and that sunlight must be admitted to each room, the author believes that the answer lies in the use of two-story houses, two rooms deep, arranged in rows of two, four, six, eight or possibly ten. In Fig. 1 are shown plans of two designs for this type of a development. In one the unit is a single house, in the other a double house. The single house contains a basement, living room, dining kitchen, two bedrooms and a bathroom, and occupies a width of 16 ft. The double house contains basement, dining kitchen, living room, one large bedroom and bathroom and occupies a width of 24 ft. Three single houses can be built in a width of 48 ft., while the same width will accommodate four families in the double-house plan. These plans, while definite in dimensions, could be changed somewhat without seriously conflicting with the costs. For instance, in some climates, as in California, the front porch could be made part of the living room at little extra expense. In the east and central states, where hot weather prevails, the porch might be considered a necessity.

The accompanying table gives cost data, annual carrying charges and rental income based on 5 per cent of the total cost for these two types of houses. The estimates are the result of long experience in such work, and similar estimates have often been used by the writer in the actual bidding of work. It will be noted that land costs and costs of utilities and improvements are included. Heating is omitted, since the plan contemplates heat from stoves or from a central heating plant. An item of $100 additional would be adequate for heat. The contractor's profit is not included.

In preparing the estimates it was assumed that raw land may be purchased for $2,400 per acre and that the subdivision and improvement cost will be $3,100 per acre, including sidewalks, curbs, concrete or asphalt pavement, sewers, water, gas and power, modern street-lighting equipment and trees in the parkways. Six 50-ft. lots would be developed per acre, so that the cost of a 50-ft. lot and improvements would be

Fig. 1—Proposed single and double row houses to rent for about $5 per room per month.



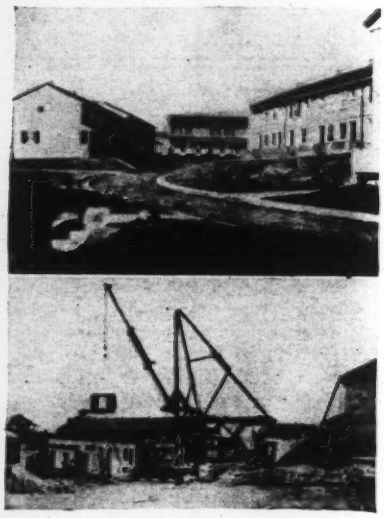


Fig. 2—Houses of the type shown in Fig. 1 made of precast concrete units built at Youngstown, Ohio, in 1918 and still in excellent condition.

$916. In the calculations a figure of $1,000 was used for each 50-ft. lot. In determining the annual carrying charges the depreciation was taken at 2½ per cent annually, since the type of construction contemplated should have a life of at least 40 years, given proper zoning measures that would assure the permanence of the residential character of the development.

There are many advantages in such a type of development, assuming the use of fire-resisting and permanent construction. Congestion is avoided by virtue of the large amount of land available for yards, parks, playgrounds, etc. By

ESTIMATE OF COST, CARRYING CHARGE AND RENTALS

Single House	
Estimated cost with front porch	$2,177.77
Estimated cost of front porch	115.28
Estimated cost without front porch	$2,062.49
Cost of land per house, three houses to 50-ft. lot	333.00
Cost of developing lot	80.00
Total cost	$2,475.49
Annual carrying charges	
Taxes, 4 per cent on half valuation	49.50
Depreciation, 2½ per cent value house	51.50
Decoration, 1½ per cent value house	31.00
Total	$132.00
Annual income	
Rent—5 per cent of total cost	123.75
Total annual charges	$255.75
Monthly rental @ $21.50—$258.00 annually	
Double House	
Estimated cost with front porch	$3,191.16
Estimated cost of front porch	143.95
Estimated cost without front porch	$3,047.21
Cost of land per house, two to 50-ft. lot	500.00
Cost of developing lot	100.00
Total cost	$3,647.21
Annual carrying charges:	
Taxes, 4 per cent of half valuation	72.95
Depreciation, 2½ per cent value house	76.10
Decoration, 1½ per cent value house	45.75
Total	$194.80
Annual income—rent 5 per cent	182.35
Total annual charges	$377.15
Annual charge, one family	$188.57
Monthly rental per family	15.75

careful grouping of the houses, attractive architectural effects may be obtained. Also, three or four families may be housed on a 50-ft. lot, effecting a considerable saving in land cost. Estimates that the author has made for a housing project of considerable magnitude, using this type of construction, show that dwellings can be provided to rent for almost one-half of the $7.50 per room that has recently come to be recognized as about the maximum rental that the low-income group can pay.

About fourteen years ago the writer's old organization, the Unit Construction Co., designed and built about 300 houses in Youngstown, Ohio, of the type advocated here. Precast concrete units were used for floors and walls. A wood wearing surface was placed on the floors, and the roofs were covered with clay tile on wood framing with a reinforced-concrete ceiling beneath. The houses were provided with basements and the usual facilities. Typical views are shown in Fig. 2.

In spite of great seasonal variation in temperature, these Youngstown houses have been perfectly satisfactory in all respects. Inspection discloses that the workmen prefer to live in them and that they are in excellent condition. These houses were built during the war under difficult labor conditions. They could be built now at a cost of 65 to 70 per cent of their original cost.

This Youngstown development is cited merely as an example. The argument presented here is that it is entirely possible to provide adequate housing for the 40 per cent of the population that receives from $1,000 to $1,500 per year, on the basis of budgeting 20 per cent of the income for rent.

Six-Dollar Housing Possible Through Design Economy

A DEMONSTRATION of what can be done in the way of low-cost group housing is provided in designs just completed for a Chicago project by engineers and architects retained by the Portland Cement Association, with the purpose of contributing to the problem of low-cost housing and at the same time bringing out the possibilities of concrete construction. Economies in space layout and structural design as well as arrangement of equipment and finish, resulted in cost estimates, based on contractors' estimates; of $6 per room per month (inclusive of land cost).

For this design a city block 600x270 ft. was taken as the basis, and the land cost was assumed at $1 per square foot. The buildings were planned to cover not more than 47 per cent of the total land area. They provide 448 apartments, totaling 1,627 rooms, the size of apartment ranging from 470 to 565 sq.ft. Most of the apartments are 3½ and 4½ rooms, but the full range is from 2 to 6½ rooms. Living room and dining room are combined; the kitchen is rated as a half room.

Other data governing the layout and design were: fireproof construction; complete plumbing provided; four families per floor per stairway; heating by individual gas-fired radiators, which will give lower first cost than a central plant; laundry located in a roof penthouse; equipment to include a gas stove, sink, refrigerator, utility closet, dish cupboard, water heater (gas-fired), bathroom containing 4-ft. tub, lavatory and toilet, and metal wardrobes in place of closets.

The structural elements, developed after a number of comparative cost studies, include monolithic concrete walls with 3-in. cinder-concrete block lining, to be painted inside and outside; non-bearing partitions 3 in. thick made of 8x16 cinder-masonry blocks, painted on both sides; solid concrete floor slabs, with 1-in. cement floor finish.

Building cost $472 per room

Cost calculations were made on a detailed estimate by an experienced building contractor, covering labor and materials. To this was added liability insurance, 8 per cent for overhead and general expense, profit of 10 per cent on the contractor's own work and 5 per cent on subcontractor's work, and a 6 per cent architectural fee. An allowance of $6,000 was made for landscaping, in addition to the cost of walks and driveways. Interest and taxes for six months, legal fee and probable cost of demolition were also included. On this basis the land cost (with legal fee, demolition, taxes and interest) amounted to $178,010, or $109 per room, and the building cost (with interest, insurance,

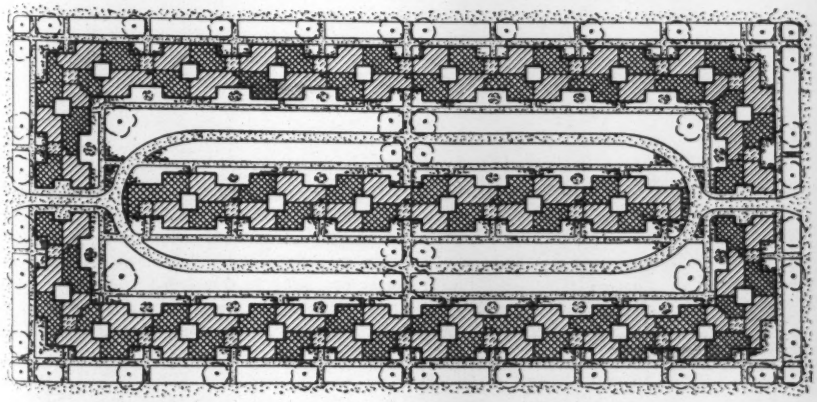


Fig. 1—Block of land 600x270 ft., with 47 per cent of ground covered with apartment groups, is claimed to be capable of renting at $6 per room per month.

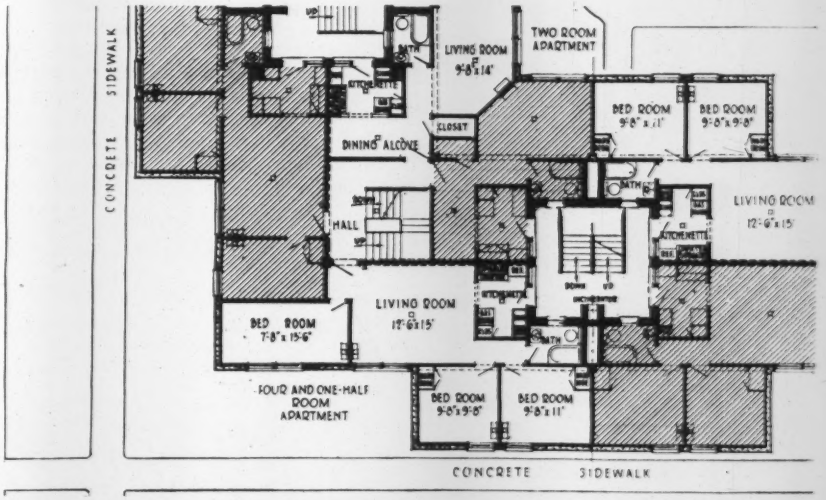


Fig. 2—Typical room layout in low-cost apartment house of concrete construction.

landscaping, architects' fee and equipment) at $768,588, or $472 per room.

To calculate the annual charges, a 65 per cent mortgage at 5 per cent was assumed, and 35 per cent invested capital to earn 6 per cent. Repairs and redecorating were estimated at $4 per room per year; vacancies and bad debts amounting to 10 per cent of income were deducted, and a 2 per cent amortization payment was provided. On this basis the total annual charges totaled $117,920. Taking this as required net annual income, the rental per room per month was found to be $6.04.

The study was made by L. H. Corning, engineer, in cooperation with Eugene H. Klaber, architect, and a group of contractors and equipment manufacturers.

Skyline Highway Tops Blue Ridge Mountains

New highway being constructed along the skyline of the famous Virginia mountain range commands a panorama of the Shenandoah and Piedmont valleys for 100 miles

PARK-ROAD design and construction have in the last half-decade become an important task of the federal highway authorities. These roads demand much from the locating engineer. They must traverse the heights and penetrate the remote places where the natural attractions are greatest, and these are usually the difficult routes, but they must be kept within very moderate cost limits. Safe and easy travel is essential, as these are roads that cater to the pleasure seeker. The Skyline Highway of the Blue Ridge in Virginia, which is described in the following article, is indicative of the problems presented and of the ability with which they are being solved. It calls attention to a function of the Bureau of Public Roads that is often overlooked in the shadow of its far greater operations of directing federal aid to states for their roads for business communication. —EDITOR.

SHENANDOAH National Park is a ribbon of territory about 90 miles long embracing the crest and upper slopes of the Blue Ridge in Virginia. The width of the park is about 10 miles, but it is so irregular that a rectangle touching the outermost edges and inclosing the whole area would be about 90 miles long and 20 miles across. Within the ribbon of park are the higher peaks of the Blue Ridge, Hawks-Bill, 4,066 ft.; Stonyman, 4,031 ft., Mary's Rock, 3,520 ft.; and Black Rock, 3,200 ft. A notable variety of terrain, ranging from the wide open plateau land of the Big Meadows, 3,000 ft. above the sea, to steep wooded slopes and precipitous rock cliffs, characterizes the park land, and wide views are afforded over the Shenandoah, Rapidan and Piedmont valleys and of the parallel Massanutten Mountains. Scenically, Shenandoah Park is one of the most beautiful in the eastern United States.

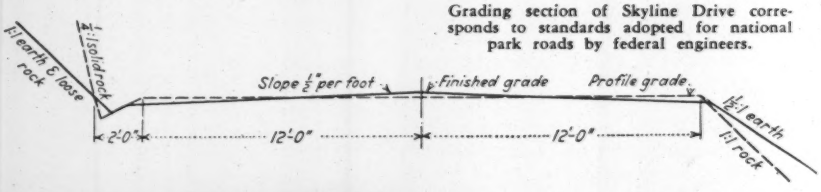
Within two and one-half hours by automobile from the summer heat of Washington and four hours from Baltimore, the new park affords a place of week-end and vacation refreshment that promises a tremendous visitation of tourists, particularly as the roads to it are through the famous Virginia cavern region and the historic civil-war battlegrounds of the valley of the Shenandoah. Access to the mountain park, however, required roads, and so a 100-mile skyline road was projected, traversing the long axis from Front Royal south to Waynesboro. About 25 miles of this road, or somewhat more than a third of its length, are now under construction. This section is the middle part, as shown by the accompanying skeleton map. Besides the main skyline route a spur road is being constructed down the Rapidan about 5¾ miles to a state highway connection. This road gives connection with the President's camp on the Rapidan and adds another entrance to the skyline drive.

Location policy

Obviously, from the preceding account, the location policy governing the park-road alignment and elevation was quite at variance with that governing the ordinary highway. Substantially the only travel would be the automobiles of vacationists and tourists seeking the views and the cool mountain elevation for holidays. The broad objective of location was to serve these two purposes. They required a road high up the mountain sides on an alignment directed to open up distant views, and openings where travelers could stop and camp and where perhaps in the future park lodges and hotels could be built. Finally, the alignment had to be easily and safely travelable and one on which construction could be held down to moderate costs.

In compliance with these conditions, the line was taken well up to the crest of the main stem of the range, or to about 3,000-ft. level. The higher peaks were threaded between by swinging the line to the east or the west flanks, as was required to develop the finest views and meet the physical and economic limitations. This meandering of alignment is indicated by the sketch map but is of course very much smoothed out because of the small scale of the

Grading section of Skyline Drive corresponds to standards adopted for national park roads by federal engineers.



Finished rough grade, showing character of valley and mountain views from the new highway.

Rock outcrops across the road drilled for blasting by jackhammers and portable compressors.

sketch. Indeed it is difficult to indicate the location task and the success of its accomplishment by graphic delineation or statement of formula.

Rigidity of formula was in fact observed rather informally, except in the broad sense that grades should be kept below 6 per cent and curves not shorter than 200 ft. in radius, that cuts and fills should have a reasonable balance, and that grading should be in tractable ground and shun as far as possible the almost adamantine rock of many of the mountain-ledge formations, all of course looking to the cost limitation of $15,000 to $20,000 a mile for a 26-ft. roadway and an 18-ft. travel surface. In brief, the instinct for location of the engineer and his keen consciousness of the scenic purpose of the road were the qualities called into service rather than close exercise of stated rules. Two days' travel by the editor, covering all sections and every viewpoint of the accessible route, was convincing of the high quality of the location secured.

Construction conditions

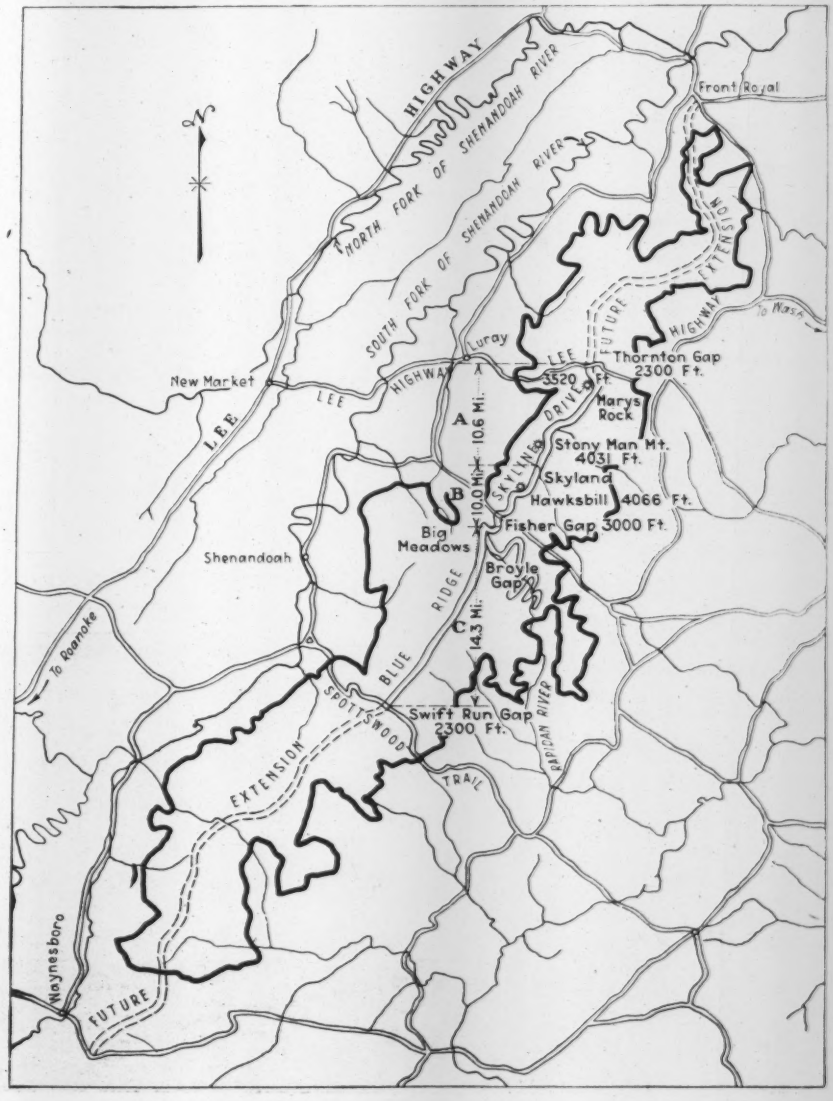
Logically, the middle section of the road was the first to be put under construction. This embraced the highest levels of the road and the portion affording the boldest scenic effects. It also was a section that could be put into service at once, without relation to the end sections, by virtue of the existence of access roads from the outside in the Lee Highway and the Spottswood Trail Road indicated on the map. This section also gives a fair picture of the mountain conditions throughout.

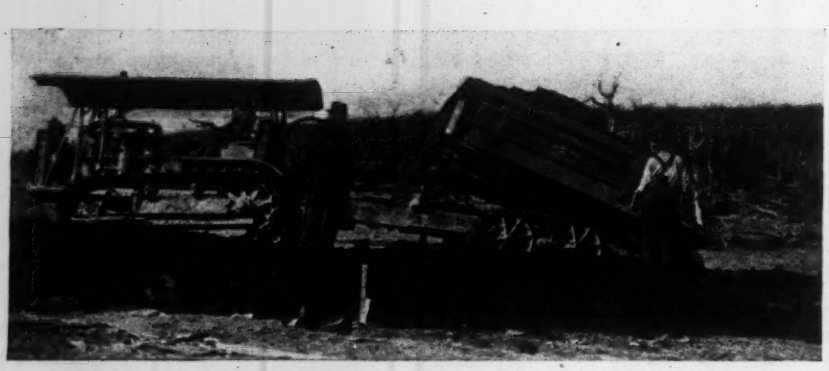
Generally, the construction operation is side-hill cut and fill varying from shelves cut in the steep sides of rocky cliffs to comparatively light grading across upland meadows and gaps. A broadly particularized survey of topography and materials on the section under construction gives the grading picture. The route considered is sections *A*, *B* and *C* on the map, which may be referred to in coordinating the description with locations.

Starting at Thornton's Gap on the Lee Highway, the 4 miles to Pinnacle Mountain is side-hill cut in steep rocky slopes on the east side of the mountains. At a mile from Thornton's Gap a knife-blade ridge from Mary's Rock could be flanked only by a near-by impossible curvature of line and was pierced by a 650-ft. two-way tunnel. Then from Pinnacle Mountain there was 3 miles of easy country with flat slopes and very little rock. More heavy side-hill rock cut followed in the ascent of Stonyman Mountain, and particularly for a mile on the north slope, which is bench section in solid rock. The east 1½ miles to Skyland was practically all rock cut, but the yardage was fairly light. Skyland marks the end of section *A*, indicated on the map.

Considerably easier topography characterized sections *B* and *C* of the road. The slopes are less steep, and there is

Shenandoah Park and Skyline Drive along the crest of the Blue Ridge Mountains in Virginia.





Tractors hauling crawler wagons share with trucks the heavy hauling task of mountain-road grading.

less rock. Open and rolling country exists over considerable stretches. Much easier conditions prevailed on sections *D* and *F*, which form the spur road down to the state road on the Rapidan.

Two contracts were let, one for sections *A* and *B*, calling for about 300,000 cu.yd. of excavation in 20.6 miles, including the tunnel, and a second for section *C* and the Rapidan spur, calling for about 200,000 cu.yd. in 20¼ miles. These yardages indicate the relative grading problems on the high-level sections *A* and *B* and the easier road coming down the eastern and southern slopes. The 2½-mile Rapidan spur is, however, a narrower road having only a 12-ft. travel way.

The character of the excavation ranged from reasonably easy soil through soil containing much blocky rock and shaley ledge to trap ledges as dense and hard as have ever been encountered. As a broad estimate, a third of the excavation was rock that had to be blasted.

Construction methods

Construction was essentially a grading operation, the roadway being finished with native soil, surface-treated. The accompanying section shows the roadway required to be graded. In general, the grading was side-hill cut, but only a moderate amount was overcast, as the fills required most of the excavation, and this required hauling. On each contract there was more than half a million station yards of overhaul. The grading operations therefore divided naturally into drilling and blasting and excavation and haulage, with equipment to correspond.

Neither operations nor equipment departed from ordinary heavy grading practice. The shovels were 1¼- and 1½-yd. gasoline or electric machines. Eight shovels altogether were worked. The 30-odd trucks ranged from ½ to 5 tons, the smaller sizes being employed in servicing operations and the 2½- to 5-yd. machines for handling excavated materials. Five of the trucks were of 4-yd. capacity, another five were 5-yd., and fifteen were 2½-, 3- and 3½-yd. In addition, there were five 60-hp. tractor-crawler wagon units. On the fills the leveling was done largely with bulldozers and blade graders operated by tractors. The compressors, except one 120-hp. stationary plant, were portable gasoline machines; sixteen were used on the work at various times. Drills, drill sharpeners and other rock-breaking equipment were of standard types. Altogether about 132 items of equipment were employed, and there were 161 men, exclusive of office forces. The equipment inventory ran about $263,000.

Steep side-hill fills are held within bounds by batter toe walls of hand-laid rubble.

Rough grade being shaped to profile with tractor-blade grader.

Direction

The construction of the highway is by contract under the direction of the Bureau of Public Roads, of which Thos. H. MacDonald is chief, H. K. Bishop chief, division of construction, and Wm. M. Austin is associate highway engineer in direct charge. The contractor for sections *A* and *B*, at a bid price of $316,981, was Albert Brothers Contracting Co., Inc., Salem, Va.; and for sections *C*, *D* and *F*, at a contract price of $171,000, was the West Virginia Construction Co., Inc., Huntington, W. Va.

The road is being constructed for the National Park Service, which will follow construction with roadside development and provision of parking areas, camp grounds and hotels as the demands of tourists and vacationists show the need of them.

How Can City Costs Be Lowered?

A Public Administrator's Answer

I—For Immediate Results: Improve Efficiency

By Clarence E. Ridley
Executive Director, International City Manager's Association, Chicago, Ill.

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DURING the past few months *Engineering News-Record* has presented a series of articles on the scope and cost of municipal services. The first, appearing in the issue of Feb. 25, 1932, p. 274, recited the recent experiences of some of our larger cities in finding their operating funds suddenly curtailed and their credit nearly gone. The facts regarding the increasing costs of municipal government were presented in the second article, which appeared on March 10, 1932, p. 365. That article demonstrated that growing urban population, improved standards of living and rising price levels have made inevitable an increase in city costs. That those costs, however, are not unreasonably high was indicated by C. A. Dykstra, city manager of Cincinnati, in the third article, published on March 31, 1932, p. 458. Considering the present state of the public mind in regard to taxes, the most important phase of the discussion is where and how city costs can properly be reduced. That is the subject of the following article. It is to be presented in two sections, the second to appear next week. The author is well equipped by his experiences as city engineer, waterworks superintendent and city manager to give a well-rounded analysis of the entire subject of economies in municipal affairs. In the present installment he explains that there is little reason to hope for a single dramatic move that will immediately stop some huge leak in city funds. Rather, a multitude of minor savings must be made in all departments, which in the aggregate will effect an appreciable economy in the city budget. The second section of the article will deal with the more important and fundamental economies that can be effected by modernizing and simplifying the structure of local government. —EDITOR.

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MUCH is being heard today about the "mad orgy of governmental spending" and the "terrifying increases in taxes." The fiscal deficits of individual cities are cited as illustrations of years of unwise spending. These statements are usually unsupported by facts, serve no constructive purpose, and if continued can have but one result: the tearing down of confidence in all government.

There is also a great amount of talk about eliminating what are called "fads and frills." Such statements assume without much analysis that if these "extra" services were discontinued, the cost of government would be substantially reduced. Here again the basic facts about government cost are not cited, if indeed they are known to some of the critics. No doubt there are some activities that could be spared without injuring the life of the city, but would it be wise from the economic or social point of view to abolish them? Just what services are unnecessary or non-essential? Such questions demand specific answer if they are to prove useful. Which of them can be abolished? A "frill" to one person is an essential service to another.

For example, if the municipal government curtails or abandons pre-natal clinics, either the work will have to be undertaken by a private agency, in which case the public would pay directly instead of in taxes, or it would be left undone, with a consequent increase in the infant mortality rate. Again, if streets are not kept in repair, the maintenance cost will be exceedingly high at a later date, or a new pavement will have to be laid at a greatly increased cost, while in the meantime there will be higher costs to vehicle owners through added repair bills. What is lost sight of is the effect of inaction or ineffective action of government on the individual's total expenditure.

While the ability to pay for municipal services must of course be given primary consideration, city officials should study all the facts carefully before making economy decisions that might cripple a community for years to come. Instead, many cities have followed two relatively easy, but not very intelligent, methods of reducing expenditures: (1) haphazard reduction or elimination of certain services that may or may not be essential; (2) blanket pay cuts affecting equally the efficient and inefficient, the necessary and unnecessary, the experienced and the novice in public service. Such broad-ax methods have no justification until all other possible devices have been tried and found wanting—unless, of course, all employees have been greatly and uniformly overpaid. No survey of governmental costs has indicated such a condition.

But city costs *can* be reduced, safely and profitably. Basic reductions will be possible only after a thorough modernization of the structure of local government. Moves of this character naturally take a long time and will not be of great value in meeting today's demands. The immediate problem is to determine how, within the existing governmental framework, the cost of city operations can be reduced. Critical analysis indicates that this can be done to good advantage by raising the efficiency and economy of operations. To be specific, we shall have to examine closely each phase of municipal activity. Let us start with that item that has suddenly assumed such large proportions—public welfare and relief work.

How to save in public welfare

The most serious item of municipal expenditure today is the cost of unemployment relief, but it seems neither possible nor desirable that total expenditures for this purpose can be reduced in the near future. Indeed, it does not appear likely that modern government can long refrain from undertaking some form of unemployment insurance if our industrial order is to continue. But even in this sphere of activity the adoption of certain fundamental principles will make the relief dollar go farther and increase the effectiveness of its expenditures.

In the first place, all welfare activities should be combined in a department of public welfare headed by a capable director and staffed with trained workers, and the work and funds of all relief organizations financed in whole or in part by the city should be administered by this department. The work of relief agencies not publicly financed should be closely coordinated under the supervision of the director of public welfare.

So far as possible, trained social-case workers should determine the needs of persons seeking relief, including hospitalization, out-relief, old-age relief, clinic service, and so on. Such activities may temporarily increase the cost of relief administration, but in the long run the economy will be demonstrated.

Better police service at less cost

Let us now look at police protection, a service that everyone will agree is vital. Can it be obtained for less money, without impairing the service given?

The New Jersey Tax Survey Commission, in its report entitled "Local Police Protection Services and Costs" estimates that police costs in four large New Jersey cities could be reduced 26

IF MUNICIPAL COSTS ARE TO BE REDUCED EFFECTIVELY

1. **Centralize all unemployment relief.**
2. **Motorize and mechanize the police force.**
3. **Spend more on fire prevention, less on fire fighting.**
4. **Control the unit costs of street-cleaning equipment.**
5. **Consolidate the various public-health activities.**
6. **Reduce the overhead in the school system.**
7. **Abolish local restrictions of public-works bidding.**
8. **Centralize city purchasing.**
9. **Modernize office practices.**
10. **Omit primary elections when there is no contest.**

per cent, and at the same time give better protection. The commission suggested motorization of the patrol force, adoption of traffic-control methods that utilize more lights, reduction in number of station men held available to respond to calls, and a reduction in overhead correspodning to the reduction in direct-duty men.

Separate police units, such as park and boulevard police, should be merged with the county or city forces, and there should be some coordination of police forces between governmental units, as is the case in the Cincinnati region. Expenditures for signal and radio equipment and automobiles should take precedence over every other type of expenditure except that for the training of men.

All police assignments should be based upon actual need as indicated by an analysis of adequate records and spot maps showing when and where crimes were committed. Special details should be reduced to a minimum, all routine clerical work should be done by civilians, high standards for entrance should be established, and effective service-rating systems set up and enforced. Reserve duty should be abolished except as it is organized as a unit under the direction of the chief or his assistant.

A central records bureau should collect and compile complete information relating to all offenses in accordance with the uniform crime-reporting system. The modern police-records system developed by the research staff of the International City Managers' Association and adopted by the International Association of Chiefs of Police has been installed by a number of cities. Its importance in police work cannot be overemphasized. It enables the police executive to exercise control over offenses committed and their investigation, and to control arrests and their disposition. It makes possible the determination of proper police assignments and distribution of patrol, indicates steps to be taken to reduce accidents, and enables the executive to determine the effectiveness of the police department, as well as the requisite size of the force.

The adoption of such a program as here outlined will result in more effective police service at a lower annual cost.

Public-works department

Savings can also be made in many public-works departments. Every city should install the complete records system devised by the committee on uniform street and sanitation records of the International Association of Public Works Officials, for without adequate records any public-works management is a haphazard affair. These records provide a systematic means for analyzing the work done and give at the same time the unit costs of performance.

For example, the street-cleaning program lists for each month what streets are to be cleaned, the frequency of cleaning and the method of cleaning. At the close of each month the work and cost statements show whether the amount of work, the unit cost, the total cost, and the work per man-hour and per equipment-hour compare favorably with the standards set. Such a records system provides a means of exercising complete control over all public-works activities, including street-cleaning, garbage and waste collection and disposal, snow removal, sidewalk repair, sewer maintenance, road-dust elimination, weed cutting and similar activities. It indicates how and where savings might be effected in each of these services.

City officials would also do well to keep in touch with the work of the newly organized national committee on street-maintenance economics, which is now developing standard methods for controlling street-maintenance operations. The plan involves measuring the amount of work done and its cost, accounting for expenditures and preparing street-maintenance programs and budgets. The committee is to design a records and cost system to aid city officials in determining when streets should be repaved, and it is also to submit standards for financing and accounting for pavement cuts by plumbers' and public utilities. The committee believes that the analysis of street-maintenance costs will also aid in determining the kinds of pavement that are most economical for different types of streets and traffic conditions. Until such standards are developed, street openings for utilities should be avoided as far as possible.

Better competition for contracts

In the construction of public improvements the administrator should see that improved municipal-contract methods and administration are adopted and that the preliminary surface and subsurface surveys by the city engineer are thorough and accurate. Such matters as specifications, additional and extra work, unbalanced bidding, etc., should be carefully checked by the proper city official. Finally, a trained and reliable inspection force is of the utmost importance.

In letting contracts for new construction there is one way of reducing costs that will be of benefit not only to the city budget but the country at large—that is, abolishing local restrictions on bidding. Competition will be stimulated by accepting the lowest responsible bidder whether he is local or not. Jackson County, Mo., saved $255,000 in 1929 and 1930 on its $6,500,000 program by letting contracts to outside contractors. (Walter Matscheck in *Kansas City Public Affairs*, Oct. 29, 1932.)

A central equipment bureau should be established to exercise control over maintenance and operation of all city-owned motor equipment. For each piece of equipment there should be an individual record on which should be noted information giving cost per mile, cost per hour or cost per unit of material hauled. The various departments requiring motor equipment should be charged a rental rate for their use.

As a further example of possible savings, the recent establishment of a centralized auto-repair division in Cincinnati has resulted in a saving of $50,000 a year. Other possible economies are reduction of number of makes of cars and trucks, purchase of gasoline in tank-car shipments, installation of time-recording devices on trucks and elimination of theft insurance and perhaps fire insurance.

Perhaps the hours during which street lights are in operation can be reduced. Some lights might be turned off entirely, and the candlepower of others reduced. Syracuse cut street-lighting costs about $60,000 a year by turning off one half of its ornamental lights.

Fire protection

Of course not even the most vociferous tax objector would countenance a lower quality of fire protection. But even in this department of city activity there is valid opportunity for economy. Cities should scrutinize their fire-control machinery to make sure that money is being spent in the direction likely to bring greatest returns in reduction of fires and losses. *There is a greater return on money spent for fire prevention and inspection activities than on costly equipment and operating crews.*

Some cities have more fire stations and equipment than is necessary. In others the fire stations are built in the wards whose councilmen make the most noise rather than where they are most needed. The location of fire stations should be determined from spot map of fires, by referring to the city plan to study the direction and type of growth and by analyzing traffic conditions and other factors.

In small thickly populated counties it should be possible to consolidate the fire forces of the several governmental units. Municipal building inspectors, electrical and other inspection forces should be required to qualify as fire-prevention inspectors as well.

The New Jersey Tax Survey Commission has urged that the question of introducing a service or protection charge be seriously considered as a means of financing a portion of the cost of fire protection. The city of Berkeley, Calif., recently enacted such an ordinance, providing for a fixed schedule of charges for apparatus called to fires that were caused by negligence.

Public health

Can the cost of protecting public health be decreased? To some extent, yes. To begin with, public-health services that are charitable in nature, such

as clinics, should be available only to those who are unable to pay. For further savings the coordination or consolidation of health activities of various governmental units would not only eliminate overlapping but would also make control of disease more effective. Dairy inspection is an example; it has been reported that a dairy in a certain California county was visited by seven inspectors in one day.

In addition to a more careful coordination of inspectional work, perhaps the frequency of inspections could be reduced without loss of effectiveness. All fees and licenses connected with health activities should be paid directly to the city treasurer instead of through the health department. Finally, the public-health budget should not include items for street cleaning, garbage disposal, maintenance of dumping grounds, etc.

Schools have more work to do

Public schooling is the largest single item in local government cost. Furthermore, the depression has materially increased the task of public education, a fact not fully appreciated by those who want to decrease the support of this activity. In addition to taking care of a bigger enrollment, especially in the high schools and vocational classes, the schools have been forced to undertake much relief work. But even with more work to do, school executives may adopt a variety of methods to reduce costs without injuring the institution they administer.

The salary budget may be reduced by using low-salaried clerks for clerical duties now performed by teachers or by placing secretaries rather than teachers in charge of attendance. The teaching staff might be reduced by adopting better methods of determining the proper ratio between teaching personnel and pupil enrollment. Some supervisors might be eliminated, given teaching assignments or allowed to replace supply teachers in filling temporary vacancies caused by illness. Vacancies can be left unfilled and teachers heretofore paid on an hourly basis eliminated. The superintendent of the Minneapolis public schools estimated last year, for example, that as much as $200,000 a year might be saved in his city if each teacher had to instruct one more pupil.

Other constructive economies in the school system include the adoption of modern office practices, reduction of the staff of janitors, better utilization of buildings through two-shift or part-time sessions, staggered pupil schedules, the platoon or work-study plan and the reduction of the number of small high-school classes. A critical study of the curriculum should be undertaken with a view to improving the utility of the educational offerings. The management of the plant and equipment should receive special attention. Insurance schedules should be carefully inspected and revised if necessary, adequate records should be kept on which to base needs of equipment and supplies, fuel costs could be reduced by the introduction of blowers and small coal sizes, while costly ventilation systems may be rendered unnecessary if the latest scientific findings are put into practice.

Large economies can be effected by dispensing with legal services that are purely formal, making greater use of the legal division of the city or the state education departments; by consolidating school and city health-inspection work; by closer coordination between the city and school authorities in developing a year-round playground program with a view to reducing overhead costs and utilizing facilities of both schools and city; by consolidating purchases of standard commodities, such as coal, with the purchases of the city and county; and by using school janitors or school-boy patrols instead of police patrolmen at street intersections adjacent to school buildings. (For additional information on educational costs see H. J. Miller's "Reducing Public School Costs," *National Municipal Review*, January, 1932, pp. 7-11; John K. and Margaret A. Norton, "What's Happening to the School?" *Survey Graphic*, June, 1932, pp. 236-8; Harold A. Stone, "Reducing Governmental Costs; Education," *The Tax Digest*, May, 1932, pp. 171-5; and New Jersey Tax Survey Commission, "A Report on Educational Services and Costs," report No. 8, 1932)

A REDUCTION in municipal costs can be effected in a variety of ways, but the choice must be carefully made.

Some departments can be abolished entirely, but at the expense of great harm to public convenience, health or safety. What is an unnecessary function to one is a vital service to another.

Public improvements can be discontinued, only to defer to a more costly future a tremendous volume of absolutely necessary construction, and in the meanwhile to aggravate unemployment and business depression and to endanger public welfare.

Broad and blanket cuts can be made in city salaries, affecting alike the efficient and the inefficient, degrading employee morale at a time when a high morale is most essential.

But a better way exists. Close study of the details of operation will disclose a multitude of minor savings that will result from increasing administrative effectiveness. Each economy made by improving operating efficiency may be relatively small, but in the aggregate an appreciable saving can be made in the year's expenditure. Best of all, the economy will be real and will be a permanent gain in the methods of adminstering municipal affairs. In this way the present stringency can be turned to real advantage instead of serious social loss.

Inspections can be consolidated

Public safety in a crowded city necessitates the enforcement of adequate building codes, and the inspectional work involved requires trained and reliable workers. In some cities this work might be combined so that each inspector has more inspections to make in a smaller territory. Indeed it is entirely possible to place all inspectional services under a single department. It would mean a material saving if a properly trained inspector did all the electrical, building and plumbing inspections within a certain territory instead of having the work done on the customary functional or craft basis. If reorganized inspections are not feasible, the city could at least coordinate transportation so that several inspectors might visit jobs together. The possibilities for economy in this field are illustrated by the fact that Buffalo now pays about $750,000 a year in salaries for inspectional services, according to the Buffalo Municipal Research Bureau. (For additional information see Edna Trull, "The Administration of Regulatory Inspectional Services in American Cities," publication No. 27 of the Municipal Administration Service, 1932.)

Public libraries are in great demand

The depression has brought greatly increased demands on the services offered by the public libraries; unemployed men and women can wait but little longer for mental food than for physical food, and of course very few can buy books. It appears, therefore, that library expenditures should not be reduced unless absolutely necessary. Every library, however, should adopt new and better ways of doing its work in order to meet necessary budget cuts without crippling essential services.

It may be necessary to postpone expenditures for extensions and equipment (except where these fit into a long-time program), to reduce the purchase of supplies to a minimum and leave vacancies on the staff unfilled. Book expenditures might be reduced by eliminating much of the lighter fiction, which has no permanent value, by waiting for dollar reprints, by buying second-hand books and by buying direct from the large jobber if his discount is larger than that of the local bookstore. Magazine subscription and binding lists should be closely scrutinized.

Other economies might be effected by simplifying charging operations (perhaps through use of machines) and order and catalog routine. Clerical workers or laborers may be used under the community "made-work" program. Administrative centralization is desirable whether it be for public library service, for school library service or

for a combination of the two services.

Elections are costly

Governmental functions that represent pure overhead can certainly be reduced in cost to good advantage. Among these is the holding of elections. Election costs can be reduced by eliminating the primary in years when there are no contests, by reducing the amount of election advertising now required by law, by letting contracts for cartage, printing and supplies on a competitive basis and by restricting special elections to a minimum. Redistricting surveys in an effort to include in non-presidential years a larger number of voters in the average election district will also make for economy. The use of voting machines and the location of polling places in schools and other public buildings to save rent wherever possible will save an additional amount of money. The adoption of the short ballot would not only cut election costs but would also center attention upon fewer candidates and lead to better government. An example of a long ballot and costly elections is found in Chicago, where each voter may vote for a total of 157 officers; in Cook County outside Chicago the number varies from 140 to 150 officials. The cost of elections under the jurisdiction of the Cook County board of election commissioners was about $3,000,000 in 1928.

Permanent registration systems have effected large savings and proved very satisfactory wherever installed. The Kansas City Public Service Institute estimates that if the permanent registration bill had passed the Missouri legislature, the city could have saved about $200,000 in 1931 and 1932, even after making due allowance for the cost of new records and equipment. As it is, the general registration in 1932 is estimated to cost between $300,000 and $400,000.

Economies in office practice

There are also numerous possibilities of effecting economies in office practices. Department heads should be held responsible for careful planning and scheduling of office work. Employees can be exchanged between departments and bureaus to meet peak loads. Stationery and forms should be simplified and standardized with a view of lithographing or mimeographing some of them. Reports that do not serve a control purpose should be eliminated. Stenographic services should be centralized. Unnecessary filing should be eliminated. Time can be saved by the introduction of inter-office memoranda in place of too frequent conferences. Rentals can be reduced by combining certain offices. In connection with the central filing and stenographic service, the city controller and city attorney, working under the chief administrator, should formulate rules and regulations for the retention, filing and destruction of records belonging to various departments.

The installation of photographic recording machines, dictating machines, and machines for billing, accounting, tabulating, bookkeeping, and numerous other mechanical devices would enable various city departments to do their work more rapidly and accurately, and at far less cost. For example, the mechanical installation for handling the billing, collection and accounting for taxes in Hamilton County (Cincinnati) is estimated to save about $75,000 the first year and more than $125,000 each succeeding year. (M. F. Hoffmann, "Mechanical Equipment and Municipal Accounting," *Public Management*, May, 1931, pp. 257-60.) In Philadelphia it is estimated by the bureau of municipal research that if the city had used the method of photographing records instead of typing them, the annual saving over a four-year period would have amounted to about $346,000 a year.

In many city halls the number of telephones can be reduced, with a corresponding reduction of the number of trunk lines. Telephone service at city expense in the homes of city officials should be eliminated at once. In some states such expenditures are illegal; in all cases the policy is of doubtful social utility. Rochester will save $25,000 this year by eliminating some of the telephones in the city hall and in residences of city officials and employees. Except in case of necessity, employees should not be permitted to make personal telephone calls, and work should be planned so as to lessen the number of long-distance telephone calls and telegrams.

Economy procedure

Usually the responsibility for the reduction of operating costs rests on the mayor or city manager, as he is concerned with the processes by which men, materials and equipment are brought together to perform public services. In ascertaining where and how to reduce expenditures the chief administrator might form a committee of the heads of staff agencies and departments. The members of this committee might be told to free their minds of the idea that because certain methods have been followed for many years it is necessary to continue them. They should then suggest what non-essentials, if any, might be eliminated, or what methods might be temporarily or permanently suspended; they should prepare reports on the work of their departments as related to other departments and suggest various short cuts and economies, all to be discussed at meetings of the committee. Representatives of research bureaus and other civic organizations should be invited to attend committee meetings and to make suggestions and criticisms.

Through such a procedure the chief administrator will obtain the cooperation of department heads and civic agencies to the end that many constructive economies may be effected. The administrative heads of other governmental units within the city or of the county should be invited to meet with the committee to decide how the various governmental units might obtain lower prices by combining orders for commodities used by all units, and how to coordinate police, fire and other activities. Of course the suggestions of the committee must be acted upon finally by the chief administrator or by the council. Perhaps some proposals may be effected only through charter or constitutional amendments or by changes in state law.

All of the decisions affecting governmental policy, whether made by mayor, city manager, or legislature, should be based on thorough investigation and analysis of all available facts. The basic research work may be carried on by some staff agency, by the local bureau of municipal research, or by an outside research agency.

To summarize, savings in city government operations can be made right now, even though there is a greater demand for city services today than in more normal times. But it must be done carefully and conscientiously if city government is to continue to perform the functions expected of it. In each department of activity a careful survey will disclose practices that can be improved in efficiency and effectiveness at a reduction in cost. Each of these economies may be small, but together it is likely that they will present a material saving in the yearly budget.

But there are some larger fields of economy still available. To exploit them properly will require a close analysis of the governmental structure of municipalities. The second part of this article, to appear next week, will carry out such an examination and will show how the organization of city government can be modernized so as to make the efficient and effective performance of all its various functions a much less expensive procedure.

British to Study Concrete

A committee has been set up by the building research board of the Department of Scientific and Industrial Research in England to review present methods and regulations for the use of reinforced concrete in building and to make recommendations for rules of practice. The immediate occasion for the appointment of the committee was a request from the London County Council, whose advisory committee had been impressed with the recent code of practice drawn up by the steel structures research committee of the Department of Scientific and Industrial Research. The concrete committee plan and operation will probably parallel those used on the steel structures committee. The chairman is Sir George Humphreys.

Close Fitting Puts Power Into Small Dredge

Suction dredge for narrow channels and shoal water given exceptional power by compact arrangement of equipment

A COMPACT machinery layout and an unusual method of handling fuel oil kept the dimensions of the new 360-hp. oil-engine suction dredge "Freeport," of the Trimount Dredging Co., Boston, Mass., to 65x28 ft., with a draft of 38 to 40 in. The boom dredge will dig to a depth of 25 ft. and was built for shoal work in narrow channels, where a large hull could not be used. The compact power-plant arrangement is indicated in Figs. 1 and 2, and is possible largely because of the use of diesel engines and diesel-electric equipment and its location at the bottom of the hull.

For the 14-in. centrifugal dredging pump there is a seven-cylinder 10½x12½-in. diesel engine of 360 hp., running at 360 r.p.m. and having a multiple V-belt drive, which gives the pump a speed of 500 r.p.m. The 35½-in. engine sheave and 24-in. pump sheave are about 3 ft. wide on the face, with 22 grooves for the belts, which are kept tight by a 16-in. idler sheave under the upper line of the belting. This increase of speed for the pump permitted the use of a smaller pump than would have been necessary with a direct-connected engine. The pump has a rated capacity of 170 cu.yd. of solid matter per hour when serving a discharge line 3,500 ft. long, assuming 10 per cent of solid matter in the water.

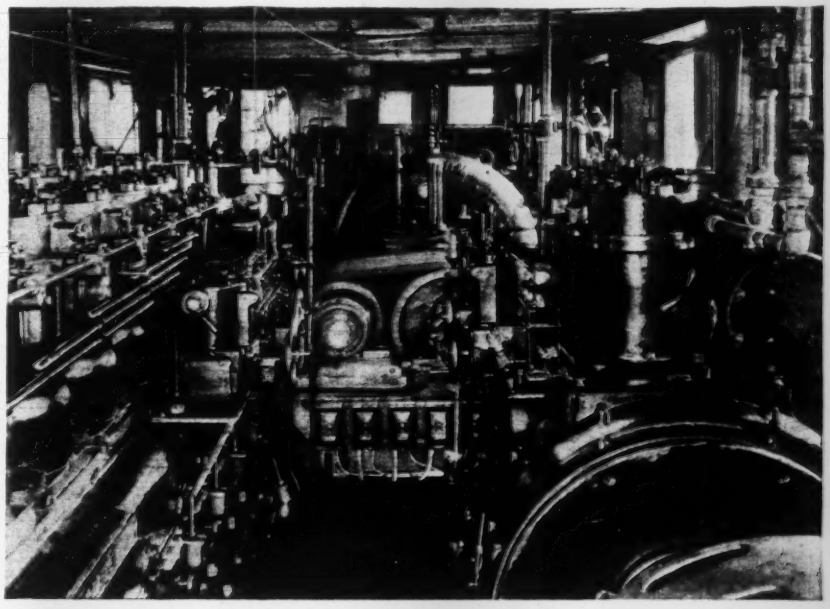
For the main electrically operated auxiliary machinery there is a three-cylinder 8¾x10½-in. diesel engine of 90 hp., direct-connected to a 60-kw. 2,400-volt alternating-current generator, having a direct-connected exciter. Both these engines are fitted with silencers on the exhaust pipes. For the motors on the smaller electrical auxiliary equipment throughout the dredge there is a 30-kva. alternator with multiple V-belt drive from a 45-hp. four-cylinder 6x6½-in. diesel engine running at 600 r.p.m. This unit is installed on the forward deck and is not shown on the plan.

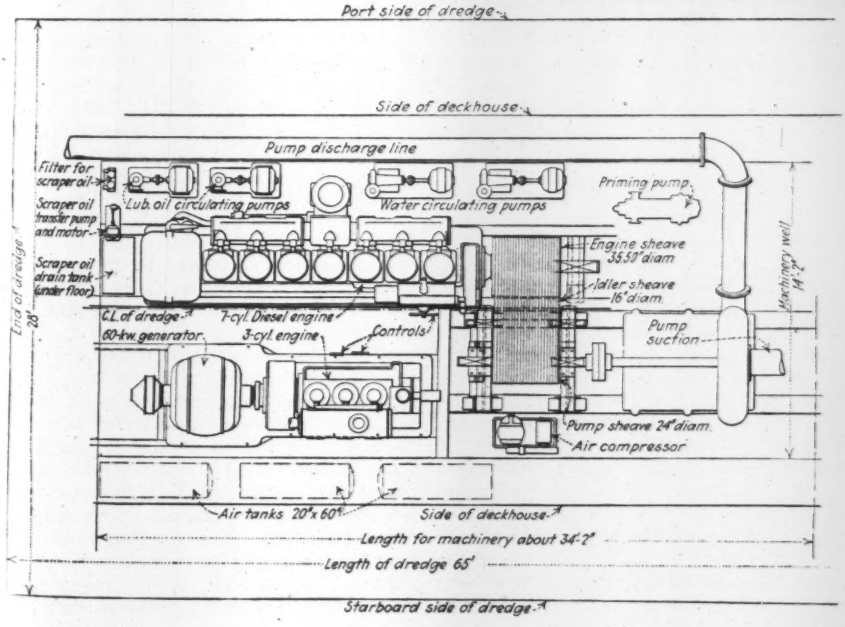
The main motor equipment includes a 40-hp. motor driving the cutter head and a 20-hp. motor for the hoisting and winding gears, both motors operating on 2,200-volt current. A centrifugal pump with 25-hp. motor serves the clear-water line at 115-lb. pressure on the packing glands and thrust bearings of the dredging pump. For the motors of the smaller auxiliaries the current is transformed to 240 volts. Two 5-hp. motors drive rotary pumps for the circulating of lubricating and piston-cooling oil, one of these being held in reserve. For circulating the cooling water there are two 2-in. centrifugal pumps, each connected directly to a 5-hp. motor. To store compressed air for starting the engines, there is a compressor on the three-cylinder generating set and also a two-stage compressor driven by a 3-hp. motor.

An unusual method of handling fuel oil has been adopted by the company for its dredges. On the "Freeport" the day-service tanks have a capacity of 800 gal., but the main storage is carried in a 15,000-gal. steel tank that floats alongside. This tank, specially built for the purpose, is weighted at the bottom and has fins or bilge keels to maintain it in proper position. The tank can be towed away for refilling,

Fig. 1—High-powered small dredge made possible by oil-engine power and belt and motor drive.

Fig. 2—Oil engine at left has rope drive to dredging pump. Oil engine at right is direct-connected to generator serving motors for machinery units.





thus saving the transfer of oil by pumping to storage tanks on board. It also reduces the fire hazard and effects a considerable reduction in the space and weight requirements for the dredge.

This dredge was designed and built by the Trimount Dredging Co., Boston, Mass., the machinery equipment and layout being planned in conjunction with Fairbanks, Morse & Co., Chicago, and the Norbom Engineering Co., Darby, Pa. The superstructure can accommodate a crew of twenty men.

Pipe Sewer Failures in the Chicago Region

By Paul E. Green
Marr, Green & Opper, Consulting Engineers, Chicago, Ill.

FROM time to time rumbles have been heard in engineering discussions and publications that indicate something wrong in the design of pipe sewers. With increasing frequency cases of cracked sewer pipes have been reported. Nineteen years ago Dean Anson Marston, Iowa State College, Ames, Ia., made extensive studies of the strength of sewer pipe in trenches and published the results; G. C. D. Lenth, consulting engineer, Chicago, further elaborated on the subject and published his figures in *Engineering News-Record*, March 27, 1924. However, engineers in the municipal field have gone gayly on designing sewer systems and ignoring the theories of trench pressure.

In the past five years in the Chicago region several outbursts of public opinion have occurred because of crushed sewers. Usually the failures were blamed on the contractor and not on the engineer, sometimes justly but by no means always so. In the Chicago metropolitan district the result has been litigation, refusal to pay assessments for the work and bankruptcy of contracting firms, to say nothing of the defective sewer or the effects due to infiltration on disposal plants.

Trouble in Homewood

In 1927, Homewood, Ill., a suburb of Chicago, let a contract for a sewerage system comprising 30 miles of sanitary sewers, 6 to 24 in., and a disposal plant composed of an Imhoff tank and two sprinkling filters. The sewage was lifted 34 ft. by centrifugal pumps to the tank and discharged through siphons and spray nozzles onto the filter beds.

Shortly after the completion of the system, but before it had been accepted by the village authorities, at times of heavy rains and for several days afterward the flow of sewage was so great that the three pumps, having a total maximum capacity of 2,400 gal. per minute, were flooded. This meant, when allowance is made for sewage, an infiltration of more than 100,000 gal. per mile of sewer per day. The flow was so great at times that the relief bypass could not handle it. The specifications provided for bituminous joints.

Since all the sewage had to be pumped, and since the discharge of the siphons was limted by the minimum head on them and by the discharge capacity of the nozzles, it was a serious situation. Further, the discharge of large quantities of sewage continuously on the filter beds radically reduced their efficiency and caused untreated sewage to be discharged into the small creek that served as an outlet. Pumping costs increased, and land owners below the sewage outlet threatened suits.

The municipal authorities refused to make final payments or to accept the work and ordered the contractor to remedy the conditions. The contractor claimed that he had performed the work in compliance with plans and specifications and that defects were not his fault but the fault of the design. He entered suit against the village to compel acceptance. Under the law in Illinois, work performed under the special assessment act is subject to final approval by the court that confirmed the original assessment. The court has summary jurisdiction to inquire into all phases of the construction. Failure to approve the work renders uncollectible the bonds issued to finance the work. The writer's firm was engaged by the municipality to investigate, report and defend the case from the engineering side, and it was bitterly fought out in court, with eminent engineering counsel on both sides.

The investigation of the physical plant was thorough. From visual observation of groundwater at various points it was determined that the main source of trouble was in the outlet, some 6,000 ft. long and 24 in. in diameter. An examination with sun mirrors was made between manholes spaced about 300 ft. apart. In addition, the sewer trench was opened at six different points and the pipe examined. The earth cover ran from 7 to 16 ft. More than one-third of the distance originally was rock excavation, while at other points the bottom was wet and soft. The trench had been dug with a dragline. The old trench was very wide, at least to the top of the pipe, though some attempt had been made to keep it narrow at the bottom. No concrete cradling had been used. The grade line as constructed was only fair, and many pieces of the bituminous joint material floated into the pump pit at the disposal plant.

Examination further disclosed that much of the pipe was cracked longitudinally, that in some instances the upper half was badly shattered, that many of the joints were open, that apparently the premolded bituminous filler had been displaced or carelessly placed in the joints, that groundwater was entering from the open joints and probably also from the various cracks in the pipe. It was testified that the pipe, if it had been carefully laid in narrow trenches and cradled where necessary, would have been strong enough to withstand the load. Some of the culled pipes remaining after the job was finished were tested and confirmed this testimony.

Experts on both sides agreed on the facts and observations but differed in their interpretation. It could be freely admitted by both sides that sufficient groundwater would enter either from the cracks (for which the village insisted it was not responsible) or from the open joints (which the village insisted was caused either by the distorted condition of the pipe under undue load or by inferior workmanship in making the bituminous joints). The municipality contended successfully, however, that the pipe, if carefully laid, would not crack and that hence the joints must have been carelessly made, and for this the contractor was responsible. The court accepted this view and held that the outlet was defective in workmanship. On appeal the findings of the court were reversed and the case was remanded with instructions for the lower court to decide what the contractor must do to render the outlet good. That particular phase is now being determined.

It is pertinent to consider the amount of groundwater infiltration. The specifications provided that such infiltration must not exceed 5,000 gal. per mile of sewer per day. This provision is common practice in the Chicago district and would mean that for the Homewood sewer the limit was 150,000 gal. per day at the disposal plant, which was designed for 6,000 people. In this case the infiltration amounted to more than 2,000 gal. per minute at times, or three million gallons per day. The testimony of the experts was unanimous that a very nearly perfect job of bituminous jointing would be required to reach the figure specified, but that such a job was possible. It was the opinion that the infiltration allowance should be revised upward for ordinary construction and that there is a great lack of accurate information on the subject. In the usual specification no discrimination is made between sizes of pipe, which is a vital matter. Thus a mile of 24-in. pipe will have a length of joint circumference of

11,053 ft., while the same number of joints of 12-in. pipe has only one-half that length. Furthermore, the area of joint exposed also varies. If 5,000 gal. per minute per day is right for the 8-in. size and means a good tight job, it is obviously too little for 24-in. pipe.

The Hazelhurst sewers

At the same time that this work was under way in Homewood there was being constructed a system of sanitary sewers varying in size from 8 to 15 in. for Hazelhurst, an adjoining town. An almost exactly similar situation prevailed there, except that the sewers were smaller. Some 6,000 ft. of sewer was in cut varying from 9 to 20 ft. The soil was treacherous, caving badly for almost the entire distance. In this case the contractor had some apprehension that there might be trouble from the depth and width of the trench, and for a short distance in the deepest cut he insisted on installing cradle. After a few hundred feet had been installed the engineer ordered him to leave out the cradle. He did this under protest but proceeded to complete the sewer without the cradle. This contract has not yet been settled.

The pipe began to crack within a few days, as was evidenced by stoppage of the sewage flow. When the flow ceased at any time an attempt was immediately made to locate the trouble, and in 51 instances it was traced to cracked crushed pipe. The contractor was forced to repair the breaks under his general guarantee and then put in a claim for extras, which the village fought, taking the position that he had to put in this cradle at his own expense. This matter has not as yet been adjudicated, and in the meantime, largely because of the trouble, the contractor has gone into the hands of his creditors.

Several lessons may be learned from these cases:

1. Pipe sewer must be protected from too wide a trench or a yielding bottom. Marston's theories of trench pressure were entirely substantiated. It is probable that most pipe sewers laid to a depth of more than 10 ft. prior to 1925 are more or less cracked because of wide trench at bottom and excessive depth and lack of a suitable cradle.

2. Concrete cradling is a very necessary part of sewer work.

3. Too much care cannot be taken with the jointing of sewers. To be successful, premolded bituminous joints must be set or forced in place by mechanical means, such as a jack.

4. Accurate information on joint infiltration is lacking, and that which is available has not been intelligently applied. Basing water-pipe leakage on diameter would seem to be a rational method. The rule suggested is that infiltration shall not exceed 500 gal. per inch of diameter per mile of sewer per day up to and including 15 in., and 750 gal. per day per inch of diameter per mile for 18- to 30-in. sizes. In addition, allowance should be made for manholes, which are a prolific source of leakage. Just what this allowance should be is difficult to say at this time, but a figure of 100 gal. per manhole per day is probably not too large, and it will be greatly exceeded unless manholes are carefully built to prevent ingress of groundwater.

5. One of the most serious lessons taught by this case is the folly of putting inexperienced laymen on sewer construction as inspectors. Even though honest and willing, they seldom realize the importance of the detailed work. Too frequently they are subject to the good fellowship of the contractor's foreman or to the slipshod idea of common labor that it is "good enough." If young engineers are not available or desired, skilled mechanics make good inspectors, as they know what good workmanship means.

6. Specifications and contracts should draw a line of distinction between ordinary routine construction work and difficult work. What may be good workmanship in one case may be poor workmanship in the second. Hence a careful description of the difficulties to be met and the results desired is essential. The necessity of impressing the bidder and contractor, as well as inspectors, with the type of workmanship that will be required is fundamental.

British Report on Deterioration of Marine Structures

A COMMITTEE of the British Institution of Civil Engineers has, since 1916, been investigating the deterioration of lumber, concrete and metal structures in sea water. Since the publication of its first report in 1920 annual interim reports have appeared, the twelfth having just been published. Important among the results relating to lumber is the work on protection against marine borers, under Professors S. M. Dixon and George Barger, which has shown remarkably promising results in increasing the protective value of creosote by the addition of certain arsenical poisons.

The investigations of the reinforced-concrete specimens under test ranged over periods up to 23 months and extended over two similar sets of short piles, one of which was exposed in sea water at Sheerness and the other in artificial sea water of three times normal strength at the Building Research Station, Watford. A large number of compression-test cylinders of mixtures used for the piles was also exposed. A report is quoted from E. A. Cullem on the internal condition of the reinforced-concrete test blocks he exposed in Brisbane port in 1917. The results of examining the bottom portions of these blocks after thirteen years of exposure led to the conclusion that a 2-in. cover of 1:2:3 or of 3:4:5 cement concrete, made with chippings ranging up to ½ in., would be sufficient for complete preservation, provided the wormanship was first-class. Four other blocks prepared to test the protective effect of tarring were broken open after having been exposed similarly for five years and indicated that coating by tar offers no advantage, although in earlier inspections the tarred specimens had seemed to be the better preserved.

During the year 1930-31 inspections were made of the iron and steel specimens under exposure for ten and fifteen years at Auckland, Halifax and Plymouth. The bars exposed to sea air at Colombo are too swollen and blistered for mere inspection to disclose any useful data, and the bars set at half-tide level and below low-water level are so thickly covered with marine growths that periodical examinations have been discontinued. As regards the bars exposed at the other three ports, the 36 per cent nickel steel aerial bars appear in all cases to be in perfect condition, and the aerial bars of 13½ per cent chromium steel appear to be corroded appreciably less than the rest of the metals exposed to air. Specimens placed at half-tide level are generally covered with marine growths, but they reveal differences according to the port of exposure. On all the bars exposed to half-tide conditions at Auckland rust spots are showing through the barnacles.

At Halifax the 13½ per cent chromium steel is in good condition save for pitting at one end, and the Swedish iron and hot-blast cast iron appear to be well preserved, while the 36 and 3½ per cent nickel steel and the Armco and Low Moor irons are in fairly good condition. The half-tide bars at Plymouth are heavily incrusted with barnacles, and the two nickel steels appear to have deteriorated less seriously than the rest. The entirely immersed bars at Auckland are all thickly covered with growths, and rust is appearing on all, but least on the nickel steel and two of the wrought irons. The bars immersed at Halifax and Plymouth are also for the most part rusty and covered with marine growths, but the original surface can still be seen on the high nickel and chromium steels.

This investigation has been carried out with grants made by the department of scientific and industrial research of the British Board of Trade.

Engineering News-Record

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Skyscraper Factories

THE controlling reason for the existence of the tall office building—namely, fullest utilization of high-priced land in congested cities—has had only limited effect with respect to factory processes. The disadvantage of receiving and dispatching raw materials and finished products on top floors of a high building outweighed the advantages. Continued improvement of the truck elevator has in large measure removed these disadvantages, however, and today we have such structures as the Starrett-Lehigh building and its counterparts in several other cities, which provide widely diversified manufacturing facilities in multi-story arrangement. When every floor can be made as accessible and convenient as the ground floor, the skyscraper factory emerges as an economical solution of one of the most important problems of urban manufacturing plant, heretofore relegated to outmoded loft buildings or to inconveniently located industrial areas.

Working for the Public

WHEN the Western Society of Engineers lost patience with the Chicago tax situation it did not stop with a protest but went on to propose a Governmental and Taxation Council to contribute to a betterment of the condition. This constitutes definite and constructive action to raise the level of public affairs. Such participation by engineering groups in the business of the community is to be welcomed, for the unprejudiced cool analysis that the engineer can supply is sorely needed today in dealing with the abnormal new problems of local government that have come into being in recent months. Let us hope that a similarly effective approach will be maintained in the further treatment of a problem so vital to public welfare, and that the activities of the proposed council will not merely reflect the hysterical and superficial thinking exhibited by much of the daily press. Continued assistance of engineers in the consideration of taxation and administration questions will go far toward assuring their solution on a basis free from bias and narrow interest.

Significant Wage Decision

UNUSUAL significance attaches to a federal court decision, given at Austin, Texas, on June 14, declaring the prevailing-wage law of Texas unconstitutional because of its bearing upon similar provisions in the laws of other states and the federal law requiring the payment of prevailing wages on U. S. government work. The decision indicates that the federal prevailing-wage law can be challenged similarly as unjust to contractors. The attack on the Texas law centered on its uncertainty. The phrase "not less than the current rate of per-hour wages for like work in the locality where the work is being performed" was declared to be too indefinite and not susceptible of exact determination. The U. S. Supreme Court is cited as saying on this point in a similar attack upon the Oklahoma law: "The 'current rate of wages' is not simple but progressive from so much (the minimum) to so much (the maximum), including all between; and to direct the payment of an amount which shall not be less than one of several different amounts, without saying which, is to leave the question of what is meant incapable of any definite answer." This weakness of the Oklahoma law is inherent in the federal law. The amendment just vetoed by the President would have eliminated this weakness; the veto again throws the matter into confusion.

The Second Leader

LESS than a year after S. W. Stratton's death, the founder of the Bureau of Standards is followed by his wise and able successor in the directorship, George K. Burgess. These two men largely shaped the growth of the important institution during these 31 years. Dr. Burgess' administration since 1923 has been eventful in respect to building up its policies and services to the government as well as to science and the industrial arts. The evolution of federal specifications to a place of commanding importance, the growth of investigation and test work in the major government offices, and the establishment of an effective basis of cooperation with industry in the solution of its research problems were largely his work. He brought to bear on every activity a thoughtful, friendly and fair attitude that contributed toward bringing about the ideal result. Not many men could have guided as successfully and as constructively the difficult study of sulphur and phosphorous effects on steel, an administrative achievement ranking worthily with his earlier scientific investigations of rails and steel quality. Administrator and scientist, Dr. Burgess made a great institution greater.

Not for Profit

IN THE usual run of the engineer's work his prime objective is greater productivity and profit. He has a different task when he undertakes something that is not for profit but aims to develop natural beauty, the country's scenic resources. National park roads, among them the just-completed Blue Ridge road, are noteworthy instances of such activity. Cost is still a factor in such work, but the dollar measure of effective planning no longer applies. Location is governed by considerations different from those of normal highway construction, and while safety and convenience remain controlling their expression in curvature, gradient and guarding depart from customary rules. A new perception of values is required, a quality not directly utilized in everyday engineering but yet important at all times, for no engineering work is devoid of esthetic and emotional implications. It is eminently desirable that the civil engineer cultivate this quality, for construction in the service of public welfare and satisfaction rather than for profit is coming to be more frequent. The elaborate parkway work of recent years is but one instance of growing trend.

Every Cent for Labor

EVERY DOLLAR that is spent for construction today goes in full amount into labor, and every cent of each dollar that is to be used for construction under the relief bill now in Congress will go into wages, whether of the shirtsleeve or the white-collar worker. This fact needs emphasis not only because many people believe that a large part of the money will leak away in waste, but also because a flood of false assertions on the subject has been spread over the land.

The facts are simple. Roughly, half of the construction dollar goes to labor on the job. Most of the remainder goes to pay for material, tools and fuel, whose cost in turn is due to labor, as the intrinsic value of the ultimate raw materials in the ground is too small to count. The residue goes to pay for supervision, planning, surveys, insurance—all of them again representing wage payments. Profit is non-existent under present-day business conditions, for everyone is bidding at or below cost. Even capital investment is disregarded, as is shown by the accounts of numerous corporations, whose plant investment has shown no earnings for months past. The price of steel, for example, is wholly made up of labor wages, in mine or on railroad or at the mill.

Beyond this, however, the same dollar works more than once to create employment, since the wage payments are promptly turned over for food, clothing and shelter, and in this process give new employment to mill hands, store clerks and transportation men, whose wage-earnings again put others to work supplying their needs. Thus, not only is it glaringly untrue that the construction dollar reduces to a small fraction of wages, as the Secretary of the Treasury recently tried to induce Congress to believe, but after every cent of the dollar has gone to the wage-earner many additional dollars of employment, wages and new production are brought into action as the result of its expenditure.

Steel Tunnel Lining a Success

THE ADOPTION of steel lining for the Boston traffic tunnel is a logical step in the change from cast to wrought metal for structural uses. When the fabrication of iron reached the stage of development that made competition with masonry a possibility, casting was the only method of its production in structural forms. From the cast columns and beams for buildings, the step to cast segments for tunnel lining was natural. But when buildings adopted steel, tunnels retained cast iron.

With comparatively small sections the handicap of greater weight was not so evident in tunnel lining. Early iron linings were considered as permanent linings, moreover, and the greater resistance of cast iron to corrosion was considered of vital importance. But perhaps the advantage that kept it longest in favor was its stiffness to resist shield thrust.

Modern tunnels of larger section made weight a constantly increasing objection to cast iron, and with the advent of concrete as an inner lining the resistance of cast iron to corrosion and its integral sufficiency to carry permanent load have become less important. Today the metal tunnel lining has become a primary lining, to be strengthened by a supplementary lining of concrete.

The lining for the Boston tunnel is primarily notable for the construction by which, for the first time, it completely fulfills in a comparatively light fabricated steel shell the requirement of integral stiffness against intensive longitudinal crumpling pressure. It has likewise shown its capacity to resist penetration by water under high heads. The modern art of structural welding played a vital part in accomplishing both of these results.

Practically, the advantages of the steel design to the tunnel builder in a tunnel of such large diameter are that materially less weight of metal needs to be handled and the metal cost per foot of lining is lowered. These gains and the complete success in taking every load put upon it in the extremely hard-pushed Boston tunnel operation definitely establish steel as a successful material for primary tunnel lining.

Efficiency in City Administration

SIX MONTHS ago the credit at the command of city governments suddenly failed, with consequent impairment of municipal services, passing of payrolls and abandonment of programs of public-improvement construction. The failure was accompanied by a clamorous flood of publicity condemning the heights to which local taxes have mounted and demanding a sharp reduction in the costs of carrying on municipal business. Since that time, fortunately, municipal securities have been recovering, but the tax-reduction pressure has continued.

Engineering News-Record has not been in sympathy with the generally hysterical clamor for a severe reduction in municipal expenditures. There is little justification for the assumption that city budgets should go up and down on the wave of the business cycle. City services are not of a nature that will allow or warrant them to be luxuriously expanded when times are flush and then severely contracted in a time of business depression. They are provided in response to a demand that has little connection with the state of trade activity, and to attempt to effect economies in accordance with such an erroneous assumption presents great hazards to city civilization and the security and amenities of life. Only by careful, painstaking analysis can city costs be reduced without endangering the community development.

We are pleased to present in this issue a critical study of the problem of reducing city costs, with specific recommendations as to how expenditures may be reduced to good advantage. It will be noted that there is nothing sensational about any of the proposals made by Mr. Ridley. In fact, it is to be recognized that the reforms he suggests would have been just as profitable five years ago as they would be today. If the pressure of the times for budget reductions can be made to result in an increase in the efficiency and a decrease in the unit costs of municipal operations, permanent advantage will have been wrung from a situation that has been threatening the safety of modern cities.

Much of the inefficiency and ineffectiveness in municipal affairs is due to the conditions under which governments are obliged to operate, rather than to the incapability of public servants. Governmental structure and traditional policies are largely obsolete and present serious limitations to sincere efforts toward really efficient administration. In our next issue these organic handicaps will be discussed by Mr. Ridley, and recommendations will be made as to how they can be removed. Only by providing a basically sound organic structure can municipal administration rise to the degree of efficiency called for by the importance of its services.

NEWS OF THE WEEK

Proposed Kentucky Bond Issue Held Unconstitutional by Court

The Kentucky Court of Appeals on June 24, upheld the Franklin County circuit court, which had held that a planned $14,000,000 state bond issue was unconstitutional. The state constitution expressly provides that in creating any debt of more than $500,000 there shall be a referendum of the voters. The state had argued that the bond issue was not creating a debt, as it would merely take up outstanding warrants. The courts held that outstanding warrant were current liabilities that the legislature should meet with increased revenue by taxation.

This decision will not affect highway contracts, which are financed from separate funds, carefully budgeted, and secured from gasoline and motor taxes. However, state contracts of some types will be affected, and contractors holding state warrants will perhaps have to hold them for some time.

Conservation of Water Resources to be Discussed in California

A meeting to discuss a state-wide water development program for California has been called by Governor Rolph to be held at Oakland on July 11. An advisory water commission, appointed recently by the governor has submitted a report which will be considered at the meeting. The possibility of calling a special session of the legislature to act on the board's recommendation also will be considered.

Prevailing Wages Determined for Twin Cities

The prevailing wages to be paid on two similar federal projects in the Twin Cities is reported to have been determined according to the following scales. One of the structures is a three-story warehouse at the U. S. veterans hospital in Minneapolis, to cost about $75,000. The other project is construction of foundations for the new postoffice in St. Paul, let at a contract price of $240,243. Both contracts were let about the same time and are now under way. The scales, as set, follow:

	Minneapolis	St. Paul
Asbestos workers	$1.06¼	....
Bricklayers	1.25	....
Carpenters	1.00	$0.85
Cement finishers	1.00	....
Common laborers	.50	.50
Composition roofers	.90	....
Electricians	1.00	1.00
Hoisting engineers	1.00	1.00
Painters	.87½	....
Plasterers and lathers	1.10	....
Plumbers	1.00	1.00
Reinf. rod workers	.60	.80
Sheet metal workers	1.12½	....
Slate and tile roofers	.90	....
Steamfitters	1.00	....
Stone cutters	1.10	....
Structural steel workers	1.25	1.25
Helpers for above trades	.60	.50
Laborers, building	..	.55
Laborers, sewer	..	.50
Pile driver	..	.70
Shovel operator	..	1.10
Truck driver	..	.50

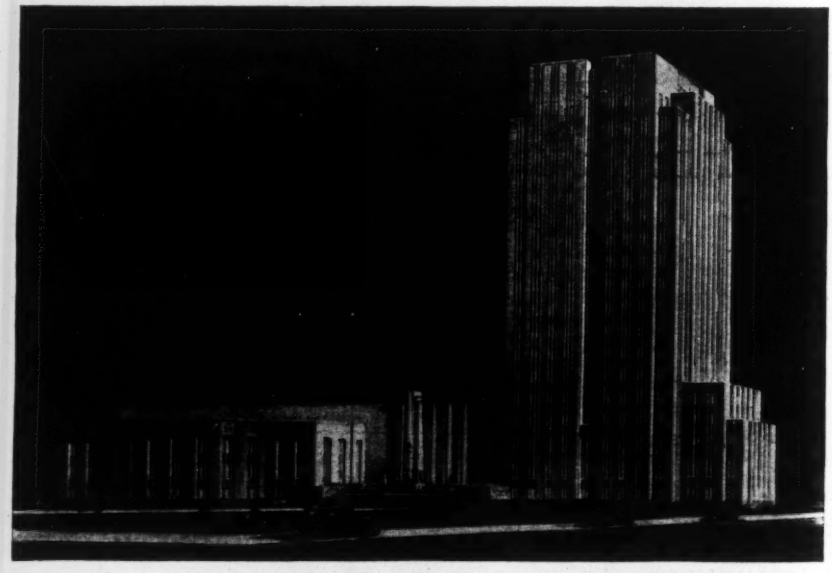
Montana Law to Limit Road Use Declared Invalid

REQUIRING a "certificate of convenience and necessity" from private contract carriers by motor vehicle, as required by a statute passed in Montana last year, has been declared invalid by the state supreme court. Requiring a contract carrier to obtain such a certificate, being not a regulation of the use of the highways but a prohibition of competition and, therefore, a measure designed to regulate the business of those using the highways, cannot stand, the court said. The court also pointed out that the statute discriminates between the private contract carrier who is carrying the goods of others under contract and the persons transporting their own goods. The distinction between these two classes of carriers admits of no diversity of treatment to the extent of excluding the one from the highway and not the other, according to the court; the public safety is in like manner endangered and the highways as much damaged by carriers hauling their own goods as by those operating under contract.

The court, in its decision, took cognizance of the recent U. S. Supreme Court decisions upholding the new Texas law for the regulation of motor vehicles on the highways of the state and a similar law in Kansas (*ENR*, May 26, p. 778 and June 2, p. 804). Neither decision bore directly on this case, the court said; in the Texas case the state's right to prescribe weight and size of the vehicles was upheld, and in the Kansas case the Supreme Court was careful to point out that the state commission had no authority to deny a *permit* to a private carrier so long as it complied with the requirements as to liability insurance and taxes.

San Gabriel Canyon Dam Advertised for Bids

Another step toward the beginning of construction of Dam No. 1 of the Los Angeles, Calif., county flood control project in San Gabriel canyon, whose estimated cost is $10,000,000, was taken June 27 when the county board of supervisors advertised for bids, to be opened Aug. 1. With bids in on that date, it is anticipated that the start of actual construction can be made a month later, giving employment to about 1,000 men. Advertising for bids was made possible through the assurance of the sale of $2,000,000 in flood control bonds. The board of supervisors on May 25 approved plans for Dam No. 1, which will impound 75,000 acre-feet of water. Construction of Dam No. 2 in the same canyon is now under way.



$2,000,000 CAPITOL FOR NORTH DAKOTA

The accepted design for the new $2,000,000 state capitol at Bismarck, N. D., to replace the building destroyed by fire in 1930, provides a structure about 389x174 ft., with an 18-story tower 93 ft. square at its base. In the tower will be the executive and department offices. The lower structure at the left is to contain the legislative chambers, the Senate seating 52 and the House 116 members. Connecting the legislative wing with the tower is the Memorial Hall, 150 ft. long, 30 ft. wide and 42 ft. high. Stone masonry will be used for the exterior. The architects for the capitol commission are Joseph Bell de Remer, Grand Forks, N. D., and W. F. Kurke, Fargo, N. D., with Holabird & Root, Chicago, as associate architects.

Washington Notes

By Paul Wooton
Washington Correspondent

ADJOURNMENT by July 9 was the goal of Congressional leaders but early in the week the fate of the public works bill was still uncertain. As this is written the result of the hurried conference between the President and Congressional leaders is not known but it is believed the President threatened to veto the conferees bill. The conferees felt that they had met President Hoover's objections when they adopted the suggestion of Secretary Mills to drop the bond issue and leave to the Treasury the financing of the emergency works program.

The conferees' agreement implies that the total for federal projects has been cut to $300,000,000 but this is misleading as the Wagner bill's provision for a $500,000,000 bond issue included $192,940,000 for projects for which funds have been appropriated.

Under the Wagner bill the Treasury was *directed* to issue $500,000,000 of emergency construction bonds. The inference attached to leaving the method of financing up to the Treasury is that the extent to which the building program will be undertaken is left to President Hoover's discretion.

The Reconstruction Finance Corp. would be authorized, under the agreement reached by the conferees, to advance to private business funds derived from the sale of its debentures. This provision will encounter strenuous opposition in the Senate where all proposals to put the Government's credit behind private business have been decisively defeated.

Wage Amendment Vetoed

President Hoover vetoed July 1 the Metcalf bill to amend the Bacon-Davis law by directing the Secretary of Labor to write into the advertised specifications for each contract the prevailing wage rates in the locality of the project. Attached to the President's veto message was a memorandum from Secretary Doak criticizing the bill as obscure and complex and impractical of administration. Secretary Doak asserted that the bill would "stretch a new bureaucracy across the country which would result only in dissatisfaction, endless controversy in enforcement and great increase in expense to the taxpayer."

Secretary Doak stated that the present law which requires all contractors on federal construction or repair of public buildings in excess of $5,000 to pay not less than the prevailing rate of wages to mechanics and laborers has worked excellently. Few disputes have arisen under this law and the amendment, said Mr. Doak, would require an enormous amount of preinvestigation by representatives of the Department of Labor.

Mead and Marvin retained

Elwood Mead, Commissioner of Reclamation, and Prof. Charles F. Marvin, Chief of the Weather Bureau, will remain in service by virtue of an executive order by President Hoover exempting them from the provision of the economy law for compulsory retirement for age. Dr. Mead has served four years beyond the age of 65 under previous extensions. Numerous officials and employees in the Interior and other departments have been granted either full or temporary exemption from the compulsory retirement provision. This has also been construed by J. R. McCarl, the Comptroller General, as not applicable to employees who have reached retirement age but have not yet served the 15-year term required for eligibility to retirement annuities from the government.

Baker and Tratman Retire from Active Editorial Work

Two members of the editorial staff of *Engineering News-Record*, M. N. Baker and E. E. R. Tratman retired from active editorial work on July 1. Both have been with *Engineering News-Record* and its predecessor, *Engineering News* more than 40 years. Mr. Tratman since 1886 and Mr. Baker since 1887.

M. N. Baker, Sanitary Expert

Moses Nelson Baker joined the staff of *Engineering News* in November, 1887, when George H. Frost, founder of that journal, was looking for a young engineer to take charge of "The Statistical Tables of American Water-Works," which had been published in 1883, 1885 and 1887, under the editorship of J. J. R. Croes, a leading hydraulic engineer of that period. Mr. Baker had graduated a year previously from the University of Vermont, and had worked as a draftsman in the bridge department of the Union Pacific at Pocatello, Idaho, and at Fitchburg, Mass.

Under the leadership of Arthur M. Wellington, Mr. Baker expanded the earlier compilation of statistics into the "Manual of American Water Works" which became the recognized authority upon the history, details of construction, equipment and costs of waterworks in this country and Canada. The manual was published as of 1888, 1889-90, 1891 and 1897. Meanwhile Mr. Baker's editorial work on *Engineering News* was expanded from waterworks over other municipal engineering operations, especially sewage and garbage disposal, public health, city government and municipal ownership of utilities.

In addition to his editorial work Mr. Baker is author of "Municipal Engineering and Sanitation," "Sewage Purification in America," "Potable Water," "Sewage Purification," and "British Sewage Works" and "British Refuse Destructors." He is joint author of "Sewage Disposal in the United States" and "Municipal Monopolies." Mr. Baker also contributed to the International Encyclopedia, first published in 1904, and to its subsequent revisions, also revisions to Nelson's loose-Leaf Encyclopedia. For 30 years he had charge of the Book review section of *Engineering News* and *Engineering News-Record*.

Mr. Baker served for 20 years on the board of health of Montclair, N. J. (his home since 1889), and as president for 10 years. In 1915 he was appointed to the state board of health and subsequently served as its vice-president. He has been active in the American and the New England Water Works Associations, the American Public Health Association and the National Municipal League. He will continue research work in the history of sanitation and the growth of municipal ownership.

E. E. R. Tratman, Track Authority

E. E. R. Tratman was born in Bristol, England, studied engineering under Edward Wilson, consulting engineer on railway work, in London, and, in 1884, came to this country and entered the employ of the Long Island Railroad. Two years later he joined the staff of *Engineering News* and remained in the New York Office until 1897, when he was sent to Chicago to become western editor.

Early training, experience on the Long Island R.R., and editorial work under Arthur M. Wellington at a time when the latter was preparing his monumental work "The Economic Theory of Railway Location" naturally led Mr. Tratman into specializing in railroad work. In 1897 he published the first edition of "Railway Track and Trackwork." With the exception of a small book entitled "Track," written by the late Wm. Barclay Parsons in 1886, this book was the first to approach the subject of track maintenance from an engineering point of view. Revised editions were required in 1901 and 1908, and in 1926 it was rewritten and published as "Railway Track and Maintenance."

Detailed reports on metal and wooden railway ties and preservation of wood ties were prepared by Mr. Tratman in 1890 and in 1894 as special agent for the U. S. Department of Agriculture. In 1895 he wrote the railway engineering section of Johnson's Universal Encyclopedia, and in recent years he has written on railway construction and structures for the International Correspondence Schools. A paper on "English Railway Track," brought Mr. Tratman the award of the Norman Medal of the American Society of Civil Engineers.

Mr. Tratman is one of the charter members of the American Railway Engineering Association and for several years served as a member of its committee on yards and terminals. He also is a member of several other railway engineering and maintenance societies in this country and in Europe. In the Illinois Society of Engineers he served as secretary for 21 years.

Cleveland Unemployed Engineers Open Cooperative Market

Cleveland Engineering Society's second project to aid unemployed engineers has just been placed in operation. It is a cooperative market where produce from the society's cooperative farm is to be sold.

The market will operate under the same plan as the cooperative farm at Gates Mills. Each engineer is paid one dollar per day in cash and credited with the number of hours worked. The profits, if any, will be divided at the end of the season. Crews will operate the stand 24 hours per day.

St. Lawrence Treaty Plan Reported Near Completion

Reports are current in Ottawa that an early announcement will be made of a final agreement between the Government of Canada and the United States as to terms of the St. Lawrence waterway treaty. No definite statement as to the status of the treaty has been made in Washington recently but several weeks ago good progress was reported.

In Canada considerable opposition to the treaty has been expressed in the Province of Quebec. The federal government also has had difficulty in Ontario, chiefly over details as to what part of the cost Ontario was to bear in return for the large amount of power to be made available by construction of the waterway.

Additional Link to Be Built in Border Highway in Texas

Construction of another section of the military highway that is to run from Brownsville, in the Lower Rio Grande Valley to El Paso, paralleling the Rio Grande for more than 1,200 miles, will be started soon, according to J. W. Puckett, division engineer of the state highway commission. This stretch of paved road is to traverse Zapata County, 50 miles. It will connect with completed sections to form an unbroken highway between Brownsville and Laredo, 300 miles. The highway also will establish a great loop that has long been agitated—a highway from Laredo along the Rio Grande to Brownsville, thence north from Brownsville to Corpus Christi, thence west to Laredo again. It will also provide a half-loop highway from Laredo to Brownsville, thence to Corpus Christi, from which place tourists and others, without having left a paved highway either in the loop or half-loop may proceed northward.

Hoover Dam Notes

General drawings for the two lower penstock tunnels were completed and checked during the week ended June 25. Preparation of construction drawings for the intake towers was continued and a revised estimate of the cost for the entire project, based on the construction of the 30 ft. penstock pipe was prepared. A preliminary draft of specifications covering the generators, transformers and oil circuit breakers has been received from the Southern California Edison Co.

* * *

Drilling operations for the Arizona intake towers were started on June 22. The plug in tunnel No. 4 has been excavated with the exception of a few tight points. The sides of tunnel No. 1 are being cleaned and excavated preparatory to pouring the concrete shelf for gantry rails. Concrete for the diversion tunnels 15,905 ft. in all, has been poured to date as follows: Invert, 5,890 ft., sidewalls, 3,200 ft., arch 359 ft.

* * *

After rising to a peak of 6,970 sec.-ft. June 21, the Colorado River dropped to 5,800 sec.-ft. on June 25.

* * *

Government thermometers registered 116° F. in Black Canyon on June 24 and 107° F. in Boulder City.

Five-Day Week in Labor Department Being Considered

INAUGURATION of a 5-day week in the U. S. Department of Labor, as an example to private industry, is contemplated according to a statement made by Secretary William N. Doak on June 30. Under the plan being considered the present Saturday half-holiday would be replaced by a full holiday, with pay reduced accordingly, to offet the 30-day furlough without pay proposed in the economy bill.

While many corporations have been forced to take up the 5-day week or less as a measure of economy, sentiment in favor of it has been increasing in recent months, the Labor Department states. Many of these plants, it is believed will continue the 5-day week when business conditions improve. In the building industry the recent union-wage survey made by the Bureau of Labor statistics showed an increasing application of the 5-day week. In the automobile industry over 44 per cent of the men are now on that basis. This is the highest percentage recorded.

George K. Burgess Dies—Director, Bureau of Standards

George K. Burgess, Director of the U. S. Bureau of Standards, Washington, died suddenly on July 2 of cerebral hemorrhage; he had only recently recovered from a stroke suffered last fall. Dr. Burgess had been with the bureau for 29 years, as physicist, head of the Division of Metallurgy, and (since 1923) director of the bureau, in which latter position he succeeded the first director, S. W. Stratton. Born at Newton, Mass., Jan. 4, 1874, Dr. Burgess was graduated from Massachusetts Institute of Technology in 1896 and took his doctorate at the University of Paris in 1901. He taught at the University of Michigan and the University of California for two years before coming to the Bureau of Standards. His scientific work as physicist was mainly in the field of high-temperature measurement and metallurgy, the application of optical pyrometry to metal in furnace and rolling processes being one of his noteworthy achievements. He also worked on light standards, rail structure, causes of rail failure, and many phases of the development of modern metallurgy. Upon becoming director he gave up most of his scientific work and devoted himself to the administrative duties of his position. A large expansion of the bureau's activities falls in this period. He was responsible for the development of the research associate system, under which many industries today carry on research work at the bureau through their own research employees, advised and assisted by the staff experts of the bureau. Dr. Burgess also participated extensively in the work of scientific and technical societies and their committees. He was a member of many societies, including the American Society for Testing Materials, of which he had been president, the National Research Council, the American Physical Society, and the American Institute of Metals. Among his numerous committee activities was the chairmanship of the A.S.T.M. committee on effect of sulphur and phosphorus in steel, which has carried on elaborate investigations for the past six or seven years. As chairman of the federal specifications board he brought the development of government specifications to their present high state.

Contract Signing Delayed For New Orleans Belt Railroad

Formal signing of the contract for construction of the New Orleans Public Belt Railroad bridge across the Mississippi River has been extended to December 31 by the State Highway Advisory Board and the Public Belt Commission. Bids were opened last September but the State Highway Commission has been unable to sell the bonds to provide the $7,000,000 for its construction. The structure is to be erected on a toll-free basis for motor vehicles. The state is to contribute $7,000,000, and the remainder of the cost is to be liquidated by the participation of railroads which will pay for their crossings.

Water District Bond Issue Upheld by California Court

Further attacks upon the validity of the $220,000,000 bond issue of the Metropolitan Water District of Southern California were obviated June 24 when the decision of the California supreme court upholding the legality of the issue became final. Failure of a taxpayer who had contested the issue's validity to apply for a re-hearing after the twenty-day period prescribed by court rules, closed the door to any further attacks. The supreme court ruled favorably for the district on all points raised in the tax-payer's suit, and his failure to petition for a re-hearing precludes any appeal to the United States supreme court.

Conservation of Flood Waters Urged for San Gabriel River

The Los Angeles county board of supervisors has been urged by members of the Long Beach water commission and other representatives of that city to consider plans to conserve a portion of the flood waters of the San Gabriel River by percolation in spreading grounds below the Whittier Narrows to raise the water level in natural storage basins on the coastal plain to provide for the future needs of more than 500,000 population.

Long Beach representatives, at a meeting June 28 with members of the flood control committee of the board of supervisors, petitioned the committee to urge the board as a whole to have engineers prepare at once a specific plan, giving consideration to:

(a) Construction of a lined by-pass conduit from the mouth of the San Gabriel Canyon to the Narrows, through which a reasonable portion of the regulated flood water from the mountain reservoirs may be conveyed.

(b) The acquisition of spreading grounds and construction of necessary works to conserve these regulated waters and flood waters from other tributaries.

(c) A report on the feasibility of constructing a regulating reservoir at the El Monte Narrows.

Two More Bridges Planned Over Rio Grande

Two more international bridges are in prospect over the Rio Grande, one in the lower valley at Boca Chica, by the Boca Chica Bridge Co., and the other in the upper valley at Fort Hancock, by the Fort Hancock-Porvenir Bridge Co. Each structure will cost about $250,000. The Mexican government has granted permits for the two bridges and bills are pending in Congress for similar authority. Both measures have passed the House. Everything is in readiness for beginning construction of the bridges as soon as congressional approval is given.

Bureau of Reclamation to Spend $5,000,000 on New Work

In addition to the fund to be expended on Hoover Dam, the Bureau of Reclamation, during the coming fiscal year, will have $5,351,500 to spend on construction. This includes $2,414,000 directly appropriated and $1,887,000 reappropriated from prior authorizations and smaller sums from commercial power revenues and other sources.

Up to the present time $31,660,000 has been appropriated for the Hoover Dam project, $10,660,000 for 1930-31 and $15,000,000 for 1931-32. The 1932-33 appropriation now is $6,000,000 but as this amount is not considered sufficient to keep the work running on schedule, the bureau hopes to have more funds made available by the legislation now pending. The present rate of expenditure is about $2,000,000 per month.

Adverse Report on Trinity River Project to Be Appealed

An appeal to the Board of Engineers for Rivers and Harbors from the adverse report made by divisional engineers of the War Department on the proposed canalization of the Trinity River from Fort Worth to its mouth in the Gulf of Mexico will be made by the Trinity Canal Association, according to John M. Fouts, general manager of the association. This project would involve the construction of locks on the river and its canalization for a distance of 275 miles. Its primary purpose is to give Fort Worth, Dallas and other towns the benefits of water freight rates. The unfavorable report was signed by Col. Warren T. Hannum, enginer in charge of the Gulf division, headquarters at New Orleans. It states, in part, as follows:

"The principal grounds upon which the adverse conclusions are based are the narrow widths, low banks, tortuous course and scant water supply of the Trinity River during critically dry periods, which make it physically unsuited for canalization," the report said.

"The cost of canalization to the federal government would be disproportionate to any benefits which might accrue to the local communities through the use of the interior waterway which thus could be obtained.

"All interested parties have the privilege of an appeal from this conclusion to the Board of Engineers for Rivers and Harbors, a permanent body sitting in Washington, D. C., to which all examinations and survey reports of this character are referred."

Study of Alkali Action on Concrete Nears Completion

AN investigation into the action of alkali on cement and concrete, started nearly ten years ago by the National Research Council of Canada with the co-operation of the University of Saskatchewan, is nearing completion. The work during the past year has been directed towards bringing the various phases of the investigation to a close. Some time must still elapse, however, before the completion of the long-time experiments on the resistance of concrete to sulphate action, which have been under way for some years. These long-term experiments deal mainly with the following:

(1) Use of siliceous admixtures in concrete.

(2) Steam-cured concrete.

(3) The efficiency of membrane waterproofing.

(4) The permanence of cements other than Portland.

The experimental work on the modification of the raw mix used in the manufacture of Portland cement, with the object of increasing the resistance of the finished product to alkali action, has yielded very promising results. This work was based on the previous laboratory experiments on the pure components of Portland cement. The preparation of alkali-resistant cement has been carried on during the last two years both on a small scale in laboratory furnaces and on a semi-commercial scale in co-operation with one of the large cement companies. Cements of extremely high resistance to alkali action have been produced and are now being tested, and further experiments are planned for the future.

Federal Aid Sought for Flood Work in California

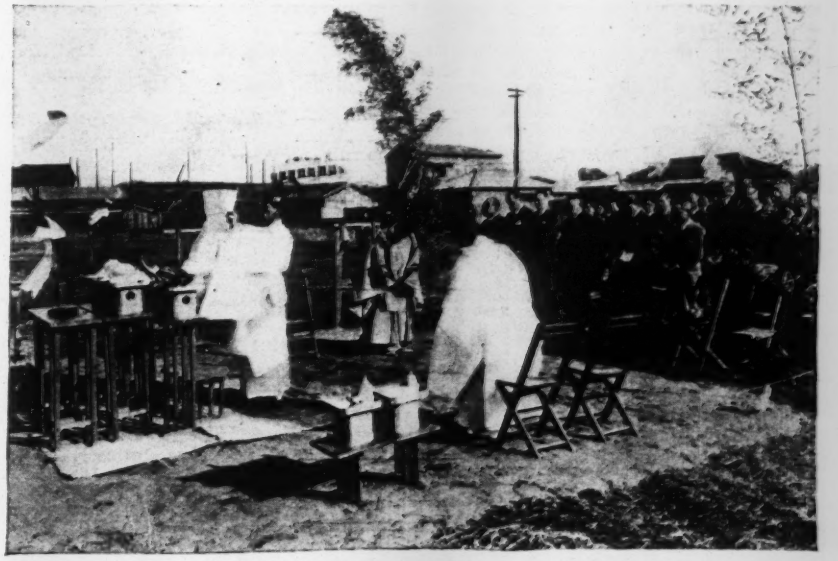
Financing of the Sacramento and San Joaquin flood-control and navigation work by the Reconstruction Finance Corporation is to be asked by California. A committee has been named by the governor's water commission to go to Washington to press the state's plea. The flood-control work in question is estimated to cost $160,000,000.

Engineers Named to Utilities Commission of San Francisco

M. M. O'Shaughnessy was named consulting engineer to the Public Utilities Commission of San Francisco on June 16. The commission was set up by the city's new charter. Lloyd T. McAfee, was made chief engineer and manager of the Hetch Hetchy system and Nelson A. Eckart was made manager of the San Francisco Water Department.

Changes in Red River Bridge in Louisiana Approved

The application of the Louisiana highway commission for approval of modified plans for the construction of a bridge across the Red River at Moncla, Louisiana, has been approved by the Secretary of War. The modified plans provide for an increase in the length of the steel swing span from 300 to 320 ft., the steel fixed span from 300 to 320 ft., the addition of one 100-ft. steel fixed span, and the addition of about 400 ft. of concrete pile trestle which will give greater floodway area. Original plans for the bridge were approved on Feb. 4, 1931, and construction of the bridge was begun on May 19, 1931.



START OF A BUILDING CONSTRUCTION OPERATION IN JAPAN

In Japan the start of a large building construction operation is a more solemn occasion than in this country. The accompanying illustration shows the high priest invoking a blessing on the operation prior to the breaking of ground for the new plant of the Otis Elevator Co. now being built between Tokyo and Yokohama, Japan.

Ferguson Now Head of Mississippi River Commission

Brig. Gen. Harley B. Ferguson, Corps of Engineers, U. S. Army has relieved Thomas H. Jackson as president of the Mississippi River Commission and as division engineer, Lower Mississippi Valley Division. The position of president of the commission carried with it the temporary rank of brigadier general. General Jackson, who now reverts to his permanent rank of colonel, was assigned as president of the commission in June, 1928 and thus completed his four-year term of duty in that assignment in June of this year. He has been assigned to Norfolk, Va., as division engineer, South Atlantic Division, the position vacated by Col. Ferguson upon his transfer.

Protest Growing Taxation Of Highway Users

Representatives of some 50 national agricultural, industrial, and private motor-vehicle using groups met in Washington on June 28, to discuss the growing use of automobiles, automobile parts, and fuel as a basis for taxation. At the conclusion of the session an informal highway users conference was decided upon as a clearing house for information. An advisory committee was created to devise a plan of operation that would prevent the further spread of such taxes.

It was noted in the discussion that the new Federal excise taxes will add $258,000,000 to the special taxes now assessed against vehicle users. Gasoline taxes now amount to from 110 to 125 per cent of the wholesale cost, and tax evasion has increased to serious dimensions.

San Francisco Engineers Declare Competence in Bascule Design

Because of the wide circulation in California of reports to the effect that bascule bridge patents would be infringed if the designs for a proposed bridge in Petaluma, Calif., were executed, the board of directors of the San Francisco Section, American Society of Civil Engineers, has adopted the following resolution:

WHEREAS, it has come to the notice of the Board of Directors of the San Francisco Section, American Society of Civil Engineers that malicious rumors are being circulated that the bascule bridge recently designed by one of our members for the City of Petaluma probably infringes on patents, that the city will have to pay damages for such infringements and that only the original holder of many of the patents is fully competent to design bascule bridges, and

WHEREAS, it is common knowledge that the patents covering essential features of bascule bridges have expired and that no royalties or damages can be collected on such patents, and

WHEREAS, the structural engineers of this region and members of this soicety, in particular, are fully competent to design bascule bridges without infringing patents,

NOW, THEREFORE, BE IT RESOLVED, that the board of directors of the San Francisco Section of the American Society of Civil Engineers condemns the circulation of such rumors and expresses full confidence in the ability and integrity of our local bridge and structural engineers,

AND, BE IT FURTHER RESOLVED, that the secretary of this section be instructed to forward copies of this resolution to the members of the City Council of Petaluma and to the Chamber of Commerce of Petaluma.

Launch Turbine Dipper Dredge

The hull for one of the first steam turbine dipper dredges ever built was launched June 22 at the Manitowoc (Wis.) Ship Building Corporation's yards for the Great Lakes Dredge & Dock Co. The Bucyrus-Erie Company is the general contractor. The length of hull is 120 ft., width, 44 ft. and depth, 11 ft. The dipper is to have a capacity of 6 cu.yd. Two oil-fired boilers will furnish steam for the 550-hp. main hoist turbine. Accommodations for 34 men will be available on the "Turbo," as the dredge was christened. A fuel oil storage of 20,000 gal. is provided. The cost will be $300,000.

SOCIETY CALENDAR

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual convention, Yellowstone National Park, July 6-9. Fall meeting, Atlantic City, N. J., October 5-8.

NEW ENGLAND WATER WORKS ASSOCIATION, annual meeting, Springfield, Mass., September 27-30.

AMERICAN PUBLIC HEALTH ASSOCIATION, annual meeting, Washington, D. C., October 24-27.

MICHIGAN CONFERENCE ON WATER PURIFICATION will be held October 5, 6 and 7 at Mt. Clemens, Mich. The Medea Hotel will be conference headquarters.

COLORADO ENGINEERING COUNCIL, Denver, elected Robert K. Fuller, architect, president; Charles W. Henderson, vice-president; Ralph B. Hubbard, secretary-treasurer.

ASPHALT INSTITUTE will hold its tenth annual asphalt paving conference at New Orleans, La., during the last week in November or the first week of December. The conference will be devoted largely to discussion of low-cost road construction. Subjects for discussion include salvaging of pavements which are in need of resurfacing by utilizing inexpensive materials, the economic aspects of tax diversion and tax evasion, and the necessity for designing roads for the service required of them.

Personal Notes

BEVERLY C. DUNN, major, Corps of Engineers, has been assigned to succeed COL. L. V. FRAZIER, as district engineer of Jacksonville, Fla.

E. H. CAMERON and M. F. FREEMAN, who have been with Jackson and Moreland have joined Arthur L. Nelson as members of the firm of Arthur L. Nelson, engineers.

E. J. BAYER, heretofore division engineer for the Big Four Railroad at Indianapolis, Ind., has been appointed division engineer of the Cairo division, with headquarters at Danville, Ill.

T. M. CAREY has been appointed engineer of maintenance and service in the Cleveland utilities department. Mr. Carey formerly was associated with James B. Clow and Sons. He will be in charge of maintenance at all plants, formerly under the charge of several men.

MAJOR A. K. B. LYMAN has arrived in Duluth to assume the duties of United States district engineer, succeeding MAJOR P. C. BULLARD. Bullard, having completed a four-year assignment at the Duluth-Superior port, has been transferred to serve as an instructor at the command and general staff school. Major Lyman was formerly stationed in the Philippines.

SAMUEL H. DICKINSON, a member of the firm of Morse and Dickinson, consulting engineers of Boston, has been appointed chief engineer of the New Hampshire State Highway Department. Heretofore, Highway Commissioner Frederick E. Everett has acted as chief engineer. Before entering business for himself Mr. Dickinson was from 1900 to 1926 with the Massachusetts Department of Public Works.

WENDELL M. REED, chief engineer of the Irrigation Service of the Bureau of Indian Affairs, under whose supervision the Coolidge Dam was constructed, retired on June 30. Mr. Reed has been in government service since 1903, first with the geological survey, and then with the Reclamation Bureau before assuming charge of the Irrigation Service of the Bureau of Indian Affairs in 1912.

Obituary

JOHN FRANCIS SMITH, engineer in charge of construction in the state highway service at Salamanca, N. Y., died June 26, of spinal meningitis. He was educated at St. Bonaventura College, Olean, N. Y., and Ohio Northern University, Ada, Ohio. He is survived by a widow and his parents.

WILLIAM WHEELER, formerly a consulting engineer of Boston, died at his home there on July 1. Mr. Wheeler was 81 years old. He was a member of the first class to graduate from Amherst Agricultural College. In his studies of engineering he specialized in hydraulics and soon after graduation took up the design, and later the construction of municipal waterworks. He was both engineer and contractor (as Wheeler & Parks) for the water supply system of Braintree, a suburb of Boston, and was engineer for the waterworks of Concord, Canton, and Watertown, Mass. The firm of Wheeler & Parks (later Wheeler Bros.) built and owned a number of waterworks under franchise. Mr. Wheeler devised the "Wheeler filter bottom" consisting of spheres above the strainers of mechanical filters.

ENGINEERING NEWS-RECORD
VOLUME 109——NUMBER 1

ENGINEERING NEWS-RECORD is a consolidation of Engineering News and Engineering Record, effected in 1917. The Contractor was consolidated with Engineering News-Record in 1918.

Engineering News was founded in 1874 by George H. Frost, as The Engineer and Surveyor, which title subsequently became The Engineer, Architect and Surveyor, then Engineering News and American Railway Journal and finally Engineering News, under the editorships of D. McN. Stauffer, A. M. Wellington and Charles Whiting Baker.

Engineering Record was established in 1877 by Henry C. Meyer as The Plumber and Sanitary Engineer. The name was subsequently changed to The Sanitary Engineer, Engineering and Building Record, and, finally, to Engineering Record. During his ownership of the paper Mr. Meyer was directly responsible for the editorial policy. John M. Goodell became editor of the paper in 1902 and was succeeded in 1913 by E. J. Mehren.

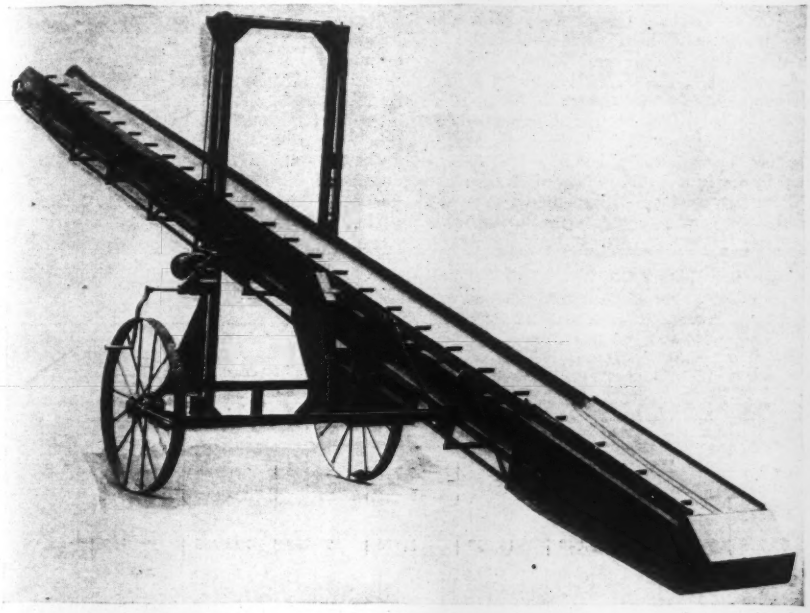
E. J. Mehren became editor of Engineering News-Record at the time of the consolidation in 1917, and was succeeded by Frank C. Wight in 1924. In July, 1928, F. E. Schmitt was appointed editor.

The editorial staff comprises: *New York:* F. E. Schmitt, editor; V. T. Boughton, managing editor; C. S. Hill, W. G. Bowman, H. W. Richardson and F. W. Herring. *Chicago:* W. W. De Berard. *Southeast:* S. T. Henry. *San Francisco:* N. A. Bowers, J. I. Ballard.

Construction Equipment and Materials

Light Portable Conveyor

A new light-weight portable belt conveyor has been introduced by the Jeffrey Manufacturing Co., Columbus, Ohio. The machine was originally designed for the handling of anthracite coal, but it is practical for unloading or reloading sand, gravel, cinders, crushed stone, bituminous coal and coke. Its rated capacity is 50 tons per hour, and it is powered with either electric motor or gasoline engine. Antifriction bearings are used throughout. The boom is of standard truss construction with the upper chords of the truss serving as skirt-boards. A sheet-metal cover over the return belt adds to its rigidity. The boom is balanced on 42x3-in. roller-bearing swivel wheels. Discharge height is regulated by a self-locking winch.



Jeffery Manufacturing Co.'s portable belt conveyor.

Road Drag for Mixing and Leveling

A new mixing and leveling drag, specially designed for mulch or retread work, is announced by the Galion Iron Works & Manufacturing Co., Galion, Ohio. The new machine accomplishes a thorough mixing of the road material and levels it ready for rolling. It has 15-in. moldboards and double bevel blades for edges. It is furnished with direct tractor hitch, rubber-tired wheels, Timken wheel bearings and inclosed lift-gear cases operating in grease. A wide range of adjustment is provided by the controls. The machine provides further adjustment of the strike-off blade and the drag unit. The strike-off has a three-piece blade, adjustable for crown. An automatic edger, 22 ft. long, is built into the machine to prevent choppy road waves. The width of the drag is 10 ft., and the rear strike-off is 11 ft. wide.

Galion mixing and leveling drag

Business Notes

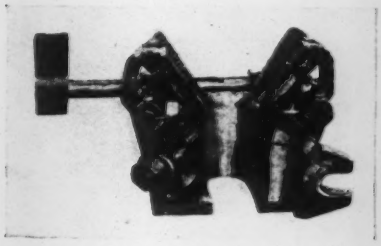
CONSTRUCTION MACHINERY CO., Waterloo, Iowa, has been purchased by P. L. Bryant and associates. Mr. Bryant, who is president of the Bryant Paving Co., becomes president of the machinery company. Laura B. Bryant is vice-president, and L. S. Holden is secretary and treasurer. The purchase includes the entire assets of the company, which involve a plant in Waterloo, of 85,000-sq.ft. floor space, on a seven-acre tract and a large warehouse in Philadelphia. An intensive sales campaign is to be started soon, directed through the nation-wide sales and service organization built around 75 jobbers.

BLAW-KNOX CO., Pittsburgh, Pa., announces the appointment of Merrill G. Baker as executive assistant to Albert C. Lehman, president of the company. For several years Mr. Baker was associated with Ford, Bacon & Davis, Inc., engineers, New York, in the capacity of assistant to the vice-president.

UNIVERSAL ATLAS CEMENT CO., a subsidiary of the United States Steel Corp., announces the election as vice-president of F. L. Stone, general sales manager, and Paul C. Van Zandt, assistant to the president in connection with operations and engineering.

Safety Clamp for Drills

A new safety clamp for diamond core drills, known as the "Bulldog" clamp, is announced by the Sullivan Machinery Co., Chicago, Ill. The body of the clamp is roughly square in shape, with a gate or hinged opening, enabling the clamp to be put over the hole quickly or removed from it while the rods are in the hole. The opening through the body of the clamp is circular and forms a smooth tapered bowl, of larger diameter at the top than at the bottom. The drill rod passes through the center of the hole and is gripped by jaws. There are four of these jaws, arranged in pairs, having cut teeth, heat-treated on their inner faces, to engage with the smooth rod, and with their outer faces rounded and tapered to conform to the bowl. When the jaws are set, the weight of the rods tends to pull them down into the bowl, and the greater the weight the tighter the jaws grip the rod. The angle of taper of the bowl and of the back of the jaws permits them to lock firmly against the rod without jamming in the bowl when they are to be released.



New safety clamp for diamond core-drills.

New Equipment in Brief

Water Meter—The Worthington Pump & Machinery Corp., Harrison, N. J., announces the model GA positive-displacement disk-type water meter. It is claimed that the new meter is highly accurate for extremely low flows as well as for intermediate and high flows. It is built in sizes from ⅝ to 2 in., with normal flow limits from 1 to 160 g.p.m. The gear train assembly comprises four cast-bronze gears and four pinions, all rigidly fastened to monel metal spindles that revolve in hard-rubber bushings. The measuring chamber is in two sections, held together by a snap joint without screws. This construction permits the case to separate without distortion in the event of freezing. Additional protection is secured by a cast-iron frost bottom on the smaller meters. The stuffing box is cast on the main case instead of being a part of the train or register box.

Tractor Crane—Announcement has just been made that the Loadmaster manufactured by Bucyrus-Erie Co., South Milwaukee, Wis., will now be available with either Case or McCormick-Deering power, and that the capacity of the crane has been increased to 4,500 lb. With its increased capacity the machine may be used as a stationary revolving-boom crane, as a crane traveling with its load or as a tractor. It is furnished with either wheel or crawler mounting.

Business Side of Construction

June Average Weekly Contracts Slightly Below May

Heavy engineering contracts reported during the month of June (five weeks) amount to 117 million dollars, an average per week of $23,379,000, compared with a total of 105 millions for May, an average per week of $26,270,000. The weekly average of contracts let in June, 1931, was $49,082,000. Cumulative contracts for the first six months of the year total 599 millions, or 60 per cent below last year's figures of 1,394 millions for a similar period. Contracts let for streets and roads accounted for the major part of the past month's construction, reaching a total of $42,500,000. Highway work awarded in May amounted to $33,347,000 while the June, 1931, contracts for this class of work totalled $62,471,000.

Public works contracts are far in the lead over private contracts. Public and private contracts for June amounted to $91,238,000 and $25,657,000 respectively, and for the six-month period $392,169,000 and $206,361,000 respectively. The largest single contracts let during June were for two public buildings in Washington, D. C., the Interstate Commerce Commission building, $8,846,000 and the post office, $7,980,000.

Construction Materials

Cement—Price of cement declined during the month in several cities, notably at Atlanta, Baltimore, Boston, Montreal, and St. Louis. Mill prices increased at Independence, Kan., and Waco, Tex.

According to the U. S. Bureau of Mines, the portland cement industry in May, 1932, produced 6,917,000 bbl., shipped 8,048,000 bbl. from mills and had in stock at the end of the month 25,365,000 bbl. Production in May, 1932, showed a decrease of 50.6 per cent and shipments a decrease of 43.3 per cent as compared with the same month last year. Stocks at the mills were 14.2 per cent lower than a year ago. The relation of production to capacity in May was 30.2 per cent, an increase over the three previous months, which showed for April, 24.8 per cent, March, 21.3 per cent and February, 18.7 per cent. In May, 1921, production was 62.8 per cent of capacity.

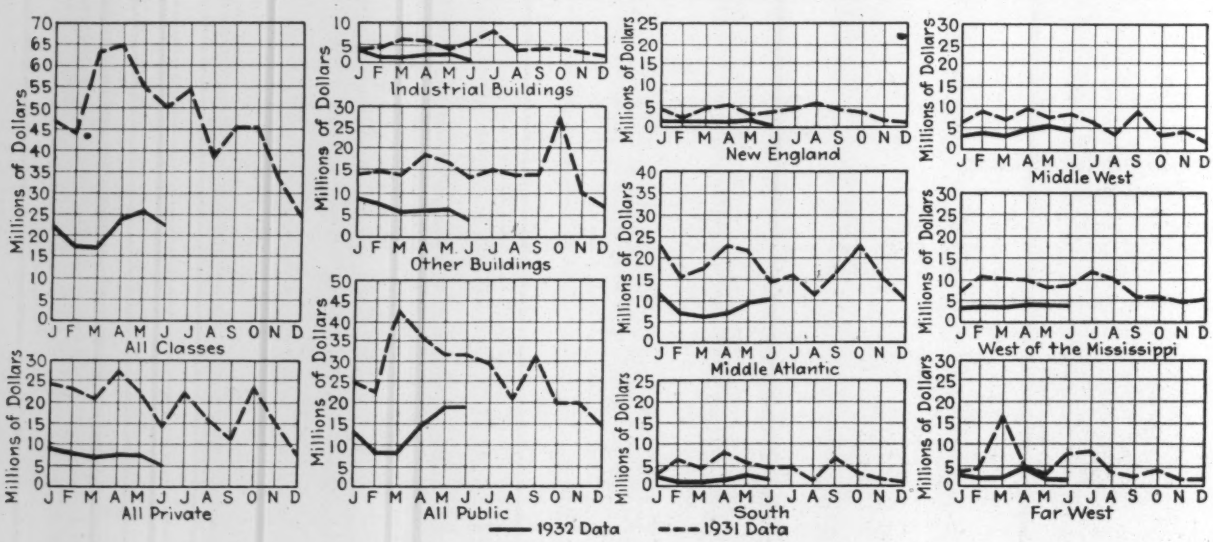
Steel—Steel prices held steady during June, in some instances showing slight increases, in the face of the lowest production figures for years. Output has dropped at the present to 15 per cent of capacity. Structural shapes and plates increased 10c. to $1.60 per 100 lb. base at Pittsburgh. Hot-rolled sheets advanced 15c. per 100 lb. at Birmingham to $1.85.

Revised figures of production of steel ingots for the month of May show an output of 1,107,424 tons, 20.11 per cent of capacity. Output of steel ingots has steadily decreased since the first of the year. The total production of steel ingots for the first five months of the year was 6,678,902 tons, 24.26 per cent of capacity, compared with 13,182,609 tons representing 48.10 per cent of capacity for a similar period last year.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED IN JUNE, 1932

Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States June, 1932	United States Six Months 1931	United States Six Months 1932	Canada June, 1932
Waterworks	87	511	167	44	92	49	950	34,566	12,398	192
Sewers	122	551	.....	1,359	164	219	2,415	35,773	13,694	.....
Bridges, public	283	1,230	67	1,229	1,787	651	5,247	51,160	25,959	100
Excavation (exc. federal)	54	72	.....	.....	7	49	182	12,558	1,848	46
Streets and roads	945	8,651	4,190	14,897	10,094	3,759	42,536	336,951	156,305	332
Federal government	905	22,033	3,826	1,750	3,168	2,423	34,105	148,259	107,890	.....
Unclassified, public	129	1,700	69	.....	23	57	1,978	49,615	26,970	.....
Buildings, public (excluding federal)	300	1,047	106	761	904	707	3,825	124,263	47,105	299
Total public	2,825	35,795	8,425	20,040	16,239	7,914	91,238	793,145	392,169	969
Buildings, industrial	1,187	2,775	436	1,240	1,214	41	6,893	94,292	45,318	70
Buildings, commercial	1,005	9,774	400	1,495	1,885	934	14,953	313,719	117,129	40
Bridges, private	.....	85	71	.....	225	100	481	6,578	2,084	.....
Unclassified, private	50	616	13	165	1,020	1,466	3,330	186,413	41,830	25
Total private	2,242	13,250	920	2,900	4,344	2,001	25,657	601,002	206,361	110
June, 1932	**5,067**	**49,045**	**9,345**	**22,940**	**20,583**	**9,915**	**116,895**	.....	.....	**1,079**
May, 1932	8,743	39,718	10,620	21,812	16,410	7,784	105,087	.....	.....	5,605
June, 1931	14,851	64,263	20,555	33,293	33,852	29,512	196,326	.....	.....	5,669
Six months, 1932	42,844	221,267	42,347	113,480	105,569	73,023	.....	.....	598,530	26,091
Six months, 1931	94,507	526,659	145,810	217,546	227,393	182,232	.....	1,394,147	.....	58,671



Value of contracts awarded—weekly averages.

Lumber—Several cities report a drop in retail lumber prices. Pine and fir form lumber declined from $3 to $4 per M in Boston. Fir is off $1 from previous quotations in St. Louis. Pine increased a like amount in Pittsburgh, with fir showing gains of $2 to $8 in the same locality.

Shipments of lumber from the first of the year to June 18 total 3,269,159 M ft., 63 per cent of last year's shipments for a similar period. Cumulative production totals 2,532,067 M ft., 52 per cent of that of last year. This production is considered 22 per cent of normal and 40 per cent of the average of the past three years.

Employment and Wages

Recent estimates place the number of unemployed in the country between 9,000,000 and 11,000,000. The American Federation of Labor places the figure at 10,634,000 for March, which is said to be increasing at the rate of 280,000 per month.

New York City—The six-week strike of building trades was ended June 16 with the establishment of a base scale of $11.20 per day. An agreement was signed to be effective until Dec. 31, 1933.

Batavia, N. Y.—Union bricklayers working on the Attica prison have accepted a reduction of $2 per day, making the scale $10.

Pittsburgh—Plumbers voluntarily reduce scale from $13.75 per day to $12. Plasterers are on strike. There is no agreement on union common labor rates.

St. Louis—Less than half of 18,000 members of Building Trades Council working, and only 30 per cent are on full time. Across the river in East St. Louis union carpenters have accepted a reduction from $12 to $10.

Dallas—Welfare department labor, utilized on sewer, water and other day labor work, will receive a minimum of 18c. per hour, to be paid in groceries, against a previous minimum of 30c.

Richmond, Va.—Union bricklayers have voluntarily reduced the scale 16⅔c. from the former rate of $1.50 per hour.

Syracuse, N. Y.—Bridge and structural ironworkers have agreed to accept $9 per day for ornamental ironworkers and $8 for reinforcing steel workers.

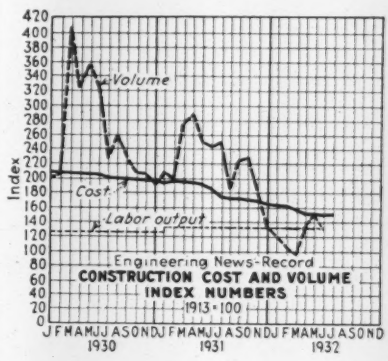
Peoria, Ill.—The first major change in scales for five years has been agreed upon, with general reductions in all trades. The new scales, effective for one year, are: bricklayers, plasterers, $1.25; carpenters, lathers, hoisting engineers, $1.00; structural steel workers, plumbers, electricians, $1.05; laborers, 65c.

Indiana—A total of 6,441 men are now employed on Indiana highways, including 215 office workers, according to Ralph E. Simpson, assistant highway director.

Minneapolis—Severe wage cutting on part of some contractors is reported, in one instance union bricklayers said to be working for 55c. per hour.

Construction Cost and Volume Index Numbers

The July Cost Index (153.36) is 1.3 per cent over that for June, but is 11.8 per cent below that for July, 1931. It is slightly higher than it was for the previous three months. The June Volume Index (134) is 12 per cent below that for May and is 46.1 per cent smaller than that for June, 1931.


Volume
Cost
Labor output
Index
Engineering News-Record
CONSTRUCTION COST AND VOLUME INDEX NUMBERS
1913=100
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1930
1931
1932

N.R.-R. Cost		E.N.-R. Volume	
July, 1932	**153.36**	**June, 1932**	**131**
June, 1932	152.20	May, 1932	149
June, 1931	187.23	May, 1931	251
1931 (Average)	181.35	1931 (Average)	220
1930 (Average)	202.85	1930 (Average)	260
1913 average	100.00		
1931		1931	
January	194.48	January	208
February	196.61	February	198
March	194.51	March	278
April	191.63	April	289
May	189.33	May	251
June	187.23	June	243
July	174.37	July	248
August	171.38	August	187
September	171.40	September	225
October	169.78	October	229
November	169.28	November	180
December	166.23	December	133
1932		1932	
January	162.48	January	121
February	161.82	February	105
March	157.24	March	97
April	153.12	April	135
May	152.78	May	149
June	152.20	June	131
July	153.36		

Contracts and Capital

CONSTRUCTION
(Thousands of Dollars)

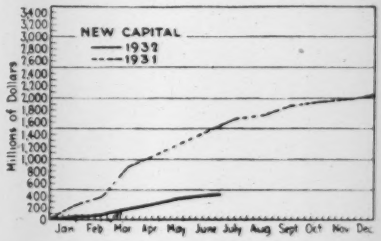
	Weekly June 1931	Average June 1932	Week July 7, 1932
Federal government	$5,039	$6,240	$12,183
State and municipal	26,395	11,784	5,663
Total public	31,434	18,024	17,846
Total private	17,647	5,172	6,129
Week's total	$49,081	$23,196	$23,975
Cumulative, Jan. 1 to date:			
1931 construction			$1,493,264
1932 construction			622,505

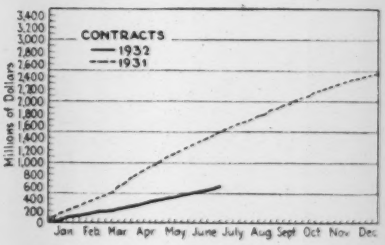
Decrease, 58 per cent.

NEW PRODUCTIVE CAPITAL
(Thousands of Dollars)

	Weekly June, 1931	Average June, 1932	Week July 2, 1932
Public	$23,750	$16,000	$4,782
Private	18,750	2,500	3,031
Week's total	$42,500	$18,500	$7,813
Cumulative, Jan 1 to date:			
1931 new capital			$1,506,500
1932 new capital			435,000

Decrease, 71 per cent.





CURRENT BUILDING AND CONSTRUCTION TRADES WAGE RATES PER HOUR

Advances since last month are indicated by **heavy type**, declines by *italics*

Cities	Bricklayers	Carpenters	Hoisting Engineers	Pile Drivers	Structural Iron Workers	Masons' Laborers	Common Laborers
Atlanta	$0.75@1.12½	$0.40@.90	$0.60@1.25	.....	$0.60@1.25	*$0.25*	$0.20@*.25*
Baltimore	.90@1.00	.80@.90	1.00@1.37½	$0.65	1.00@1.25	.40	.30
Birmingham	.75@.87½	.60	.75	.....	.75	.35@.40	.15@.30
Boston	*.90*@1.30	*.80*@1.17½	1.00@1.37½	.75@1.07½	1.00@1.37½	.45@.70	.40@.70
Cincinnati	.90@1.27½	.50@1.02½	1.07½	1.07½	1.06¼@1.20	.70	.40@.45
Chicago	1.37½	1.31¼	1.31¼	1.31¼	1.35	.82½	.50@.82
Cleveland	.90@1.37½	.87½@1.12½	.90@1.12½	1.00	.90@1.06¼	.56¼	.30@.72
Dallas	1.00@1.12½	.75@.87½	.87½	.87½	.87½	.30@.40	.20@.25
Denver	1.00@1.12½	.75@.87½	.75@.87½	.....	.75@.87½	.50	.31¼@.50
Detroit	1.25@1.50	.80	1.25	1.25	1.25	.70	.30@.50
Kansas City	1.30	1.12½	1.12½	1.06	1.12½	.82½	.25@.70
Los Angeles	.62½	.50	.75	.75	*.62½*	.50	.35@.50
Minneapolis	1.10	.75	.80	.....	.90	.70	.45
New Orleans	.60@.80	.40@.50	.80@1.12½	.90	.80@1.12½	.50	.15@.20
New York	1.50@1.65	1.25@1.40	1.50@1.65	1.50	1.50	.81¼@1.00	.50@*.75*
Philadelphia	1.00@1.25	.60@.90	1.00	.75	1.00	.30@.40	.20@.30
Pittsburgh	.60@1.50	.60@1.25	.60@1.37½	1.00@1.18¾	.60@1.37½	.50	.40
St. Louis	1.50	1.25	1.35@1.47	1.25	1.47	1.00	.35@.78¾
San Francisco	1.10	.90	.90	1.00	1.00	.62½	.40@.62½
Seattle	.75@1.20	.50@.90	1.00	.90	1.10	.66	.40@.50
Montreal	1.25	.75	.75	.75	.93	.40	*.35*

Current Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

Building Materials

PORTLAND CEMENT — Prices are for carload lots. For cement in returnable cloth bags add 40c. per bbl.; in non-returnable paper bags add 15c. per bbl., to following net prices:

	F.o.b.	Delivered		F.o.b.	Delivered
Atlanta	*$2.02*	*$2.08*	Kansas City	*$1.30*	*$1.40*
Baltimore	....	*1.77*	Los Angeles	....	2.10
Birmingham	1.83	1.93	Minneapolis	1.83	1.95
Boston	*1.58*	*1.68*	Montreal	*1.70*	....
Chicago	1.18	1.53	New Orleans	1.86	2.20
Cincinnati	1.52	1.64	New York	**1.49**	**1.60**
Cleveland	1.25	1.50	Philadelphia	1.53	1.63
Dallas	2.23	2.38	Pittsburgh	1.68	1.78
Denver	....	2.40	St. Louis	*1.34*	*1.85*
Detroit	1.47	1.80	San Francisco	2.45	....
Jersey City	1.53	1.63	Seattle	2.55	2.70

Current mill-prices per barrel to dealers, for carloads of 132 barrels or over, without including charge for four bags, f.o.b. Bag charges same as in preceding table:

Alpena, Mich	$1.20	Mason City, Ia	$1.10
Buffington, Ind	1.10	Norfolk, Va	1.61
Dallas, Tex	1.75	Northampton, Pa	1.21
Hannibal, Mo	1.10	North Birmingham, Ala	1.31
Hudson, N. Y	1.21	Richard City, Tenn	1.31
Independence, Kan	**1.35**	Steelton, Minn	1.61
Ironton, Ohio	1.06	Universal, Pa	1.21
Iola, Kan	1.10	Waco, Tex	**1.75**
La Salle, Ill	1.10	Wyandotte, Mich	1.20
Limedale, Ind	1.10		

SAND AND GRAVEL — Per ton, carload lots, gravel, size ¾-in.:

	Gravel		Sand	
	F.o.b.	Delivered	F.o.b.	Delivered
Atlanta	$1.95	$2.75	$1.50	$2.50
Baltimore	....	2.55	....	2.08
Birmingham, per cu.yd	....	3.00	....	2.40
Boston	1.50	1.75	1.00	1.25
Chicago, per cu.yd	....	2.25	....	2.25
Cincinnati	1.30	1.60	1.05	1.35
Cleveland	....	2.00	....	2.00
Dallas, per cu.yd	1.00	1.50	1.00	1.50
Denver, per cu.yd	1.75	**1.85**	1.15	*1.20*
Detroit	.50	*1.45*	.72	1.50
Kansas City	.75	1.25	.60	1.10
Los Angeles	1.35	1.45	.85	1.00
Minneapolis	....	1.60	....	.65
Montreal	1.50	....	1.25	....
New Orleans	1.50	2.50*	1.20	2.00*
New York, per cu.yd	1.60	3.25	1.00	2.00
Philadelphia	....	1.66	....	1.38
Pittsburgh	....	*1.20*	....	1.40
St. Louis	*1.00*	1.55	.80	1.35
San Francisco	....	1.75	....	1.75
Seattle, per cu.yd	1.75	....	1.75	....

*Cu.yd.

CRUSHED STONE — Per ton, size 1½-in., carload lots, limestone:

	F.o.b.	Delivered
Atlanta	$1.95	$2.75
Baltimore	....	2.60
Birmingham	.80	1.05
Boston	*1.10*	1.88
Chicago, per cu.yd, 2,500 lb	....	2.25
Cincinnati	1.65	1.85
Cleveland	....	2.00
Dallas, per cu.yd., 2,500 lb	1.90	2.90
Denver, granite, per cu.yd., 2,700 lb	....	2.50
Detroit	1.09	1.95
Kansas City	1.25	2.00
Los Angeles	1.35	1.45
Minneapolis	....	1.60
Montreal	1.35	....
New York, per cu.yd., 2,800@3,000 lb	1.60	3.25
Philadelphia	....	2.00
Pittsburgh	....	3.50
St. Louis	1.35	1.65
San Francisco, trap rock	....	1.65
Seattle, per cu.yd., 3,000 lb	1.10	....

CRUSHED SLAG—Prices for carloads, per net ton, at plant:

	1½-In.	¾-In.	Roofing	Slag Sand
Birmingham	$0.90	$1.15	$2.05	$0.55
Buffalo	1.35	1.35	*2.25*	*1.25*
Cleveland	1.10	1.10	2.25	.70
Toledo	1.20	1.20	1.25	1.10
Western Pennsylvania	1.25	1.25	2.00	1.25
Youngstown	1.10	1.20	2.00	.75

CONCRETE BLOCKS—Standard, 8x8x16-in., hollow, delivered to job, each:

Birmingham (5x8x12)	$0.084	Kansas City	$0.18
Boston	.17	Los Angeles	.15
Brooklyn and Queens	.12	Minneapolis	*.09*
Chicago	.175	New Orleans	*.18*
Cleveland	.165	Philadelphia	.15
Denver	.15	Pittsburgh	.15
Detroit	*.08*	St. Louis	.14

READY MIXED CONCRETE—Per cu.yd., 1:2:4, delivered 50 cu.yd. or more:

Atlanta	$7.75	Los Angeles	$5.40
Birmingham	6.00	Minneapolis	5.50
Boston	7.50	New Orleans	6.20
Cincinnati	7.10	New York (Manhattan)	8.50
Dallas	6.00	Pittsburgh	5.75
Detroit	5.90	St. Louis	6.65
Kansas City	7.50	Seattle	5.35

HOLLOW TILE—Building tile per block, delivered to contractors in lots of 2,000 pieces or over:

	4x12x12	6x12x12	8x12x12	10x12x12	12x12x12
Atlanta	$0.09	$0.11	$0.13	$0.20	$0.25
Baltimore	.10*	.14	.20	.22*	.30
Birmingham	.089	.122	.167	.219	.25
Boston	*.075*	*.11*	*.135*	*.195*	*.22*
Chicago	.0484	.063	.09	.1179	.13
Cincinnati	.06815	.09485	.129	.165	.184
Cleveland	.048	.066	.09	.117	.13
Dallas	.084	.121	.159	**.177**	.234
Denver	*.085*	.135	.175	*.19*	.25
Detroit	.0505	.11	.145	.1175	.21
Kansas City	.0755	.092	**.15**	.17775	.20725
Los Angeles	.09425	.134	.188	.2325	.3135
Minneapolis	.0635	.09395	.1232	.13425	.2103
New Orleans	.085	.115	.16	.225	.253
New York	.075	.125	.14	....	....
Perth Amboy	....	....	....	.2388*	.2956*
Philadelphia	.105	.14	.215	.28	.34
Pittsburgh	.0435	.065	.088	.1165	.126
St. Louis	.067	.098	.12	.16	.20
San Francisco	.0765	.105	.1765	....	....
Seattle	.085	.115	.18	....	....

*At plant.

BRICK — Prices per thousand in carload lots, as follows:

	Common Backing		Face		Paving F.o.b.
	F.o.b.	Delivered	F.o.b.	Delivered	3x8½x4-in.
Atlanta	$8.50	$14.00	$15.50	....	$32.00
Baltimore	....	12.00	....	$25@35	43.00†
Birmingham	10.00	12.50	20.50	23.00	27.00
Boston	11.00	*12.00*	25.00	*26.50*	*43.00*
Chicago	....	9.00	....	32.50	32.00
Cincinnati	13.50	16.00	.....	24.00	36.50
Cleveland	12.00	14.00	.....	24.00	33.00
Dallas	....	12.00	....	23.00	25.00
Denver	13.00	....	18@27	....	40.00
Detroit	11.50	12.50	26@30	28@32	25.00
Kansas City	12.00	13.00	20.00	23.00	35.00
Los Angeles	8.00	8.50	24.00	24.00	.....
Minneapolis	.....	8.50	.....	**30.00**	.....
Montreal	....	16.00	....	35.00	....
New Orleans	10.50	14.50	40.00	45.00	40.00
New York	*9.50*	*11.00*	28.00	30.00	45.00
Philadelphia	.....	13.00	.....	25@30	40.00
Pittsburgh	8.00	10.00	18.00	22.00	25.00
St. Louis	.....	12.00	.....	22.00	30.00
San Francisco	....	14.00	.....	.....	45.00*
Seattle	12.00	14.00	.....	.....	48.50

*2½x8½x4-in. †3½x8½x4 in.

LIME — Prices of hydrated, per ton, in paper; lump, per 180-lb. bbl., net:

	Hydrated Finishing		Hydrated Common		Common Lump,	
	F.o.b.	Delivered	F.o.b.	Delivered	F.o.b.	Delivered
Atlanta	$13.50	$18.00	$11.50	$15.50	.....	$2.50
Baltimore	.....	20.00	.....	13.00	.....	....
Birmingham	.....	21.00	.....	12.00	.....	1.65
Boston	*17.00*	*19.00*	*11.00*	*12.00*	*$1.90*	*2.15*
Chicago	.....	20.00	.....	14.00	.....	2.75
Cincinnati	11.00	12.00	9.40	10.40	.....	....
Cleveland	10.50	14.00	8.50	12.00	.....	2.50
Dallas	.....	20.00	.....	.....	.....	2.50
Denver	.....	30.00	.....	*22.00*	.....	*2.87**
Detroit	8.90	14.00	7.00	12.00	.....	....
Kansas City	.....	22.00	.....	.....	.....	2.75
Los Angeles	.....	26.00	.....	18.00	.....	2.00
Minneapolis	.....	21.00	.....	19.00	.....	1.70
Montreal	.....	18.00	12.00	13.00	.....	....
New Orleans	14.75	22.50	11.58	14.00	1.66	1.95
New York	*10.70*	*14.00*	8.60	*12.50*	2.25*	3.15*
Philadelphia	.....	18.00	.....	14.50	.....	14.00†
Pittsburgh	11.50	13.00	10.75	12.25	1.85	*2.35*
St. Louis	.....	.45‡	.....	.40‡	11.50†	12.50†
San Francisco	19.00	....	19.00	....	1.59	....
Seattle	.....	32.00	.....	24.00	.....	2.80

*Per 280-lb. bbl. (net.) †Per ton. ‡Per sack.

LIMESTONE—Mill blocks, f.o.b. siding, per cu.ft.:
New York: Rustic buff, $1.37; Standard gray, $1.47; Standard, $1.57; Selected gray, $1.57; Selected buff, $1.67.
Boston: Rustic buff, $1.43; Standard, $1.56; Selected buff, $1.70.
Pittsburgh: Rustic buff, $1.56; Standard, 1.28*; Selected buff, $1.86.
Atlanta: Standard, $1.26.
*At quarry

SLATE—Roofing, f.o.b. quarry, Bangor, Pa., net, per square;

No. 1 Clear	$8.25@$9.50
No. 1 Ribbon	6.75@ 7.50
Medium Clear	7.25@ 8.00

Road and Paving Materials

PAVING STONE — Granite, lots of 50,000 blocks, 4x8x4-in., dressed, f.o.b. city:

Atlanta	$3.00 per sq.yd.
Baltimore	3.00 per sq.yd.
Birmingham	76.25 per M.
Boston	*100.00* per M.
Chicago, 5 in	3.80 per sq.yd.
Cincinnati	110.00 per M.
Cleveland	95.00 per M.
Detroit, 5 in	2.80 per sq.yd.
Kansas City	*3.75* per sq.yd.
Minneapolis, 4½ in	2.80 per sq.yd.
Montreal	104.75 per M.
New Orleans	2.80 per sq.yd.
New York, 5 in	120.00 per M.
Philadelphia, 4x10x5	115.00 per M.
Pittsburgh	115.00 per M.
St. Louis, 5 in	3.10 per sq.yd.

Current Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*.

Road and Paving Materials—Continued

WOOD-BLOCK PAVING — Prices f.o.b., in carload lots:

	Size of Block	Treatment	Per Sq.Yd.
Atlanta	3½	16	$2.25
Boston	3½	16	*2.15*
Chicago	3½	12	1.90
Kansas City	3½	16	2.75
Minneapolis	3½	16	*2.25*
Montreal	3½	16	2.63
New York	3½	14	1.90
St. Louis	3½	16	2.10

CURBING—Per lin.ft., 5x16 in., straight, rough, f.o.b., in carload lots:

Atlanta	$0.41	Detroit	$0.45
Birmingham	.50	New York	.68
Boston	.70	Pittsburgh	.80
Dallas	.60	St. Louis	.75

ASPHALT—Paving asphalt, f.o.b., per ton. Packages are 350-lb. bbl. or 425-lb. drums, in carload lots:

	Packages	Tank-car or -boat
Atlanta	*$18.40*	*$14.40*
Baltimore (f.o.b. refinery)	16.00	12.00
Birmingham	.....	11.00
Boston	21.00	17.00
Chicago	22.50	15.50
Cincinnati (f.o.b. refinery)	.....	8.00
Cleveland	18.25	14.50
Dallas	.....	27.00
Denver	27.50	.....
Detroit	**16.80**	12.43
Kansas City (f.o.b. refinery)	*18.00*	*12.00*
Los Angeles (f.o.b. refinery)	18.00	12.00
Maurer, N. J. (Bermudez)	.....	25.00
Maurer, N. J. (Trinidad)	.....	21.00
Minneapolis (f.o.b. Twin Cities)	20.00*	16.30
Montreal (f.o.b. factory)	17.00	13.00
New Orleans (f.o.b. refinery)	16.00	12.00
New York (f.o.b. refinery)	16.00	12.00
Philadelphia	16.00	10.00
Pittsburgh	25.00	16.00
St. Louis (f.o.b. refinery)	**14.00**	**10.00**
San Francisco (f.o.b. refinery)	14.00	8.00
Seattle (f.o.b. refinery)	16.00	10.00

* Refinery.

LIQUID ASPHALT — Residual, hot application, f.o.b., in tank cars, 8,000 gal. minimum, per gal.:

Atlanta	$0.06
Birmingham	.06
Boston	.055
Cincinnati	.075
Dallas	.05
Los Angeles	.045
New York	.05
Pittsburgh	.05
St. Louis (at refinery)	.035

EMULSIFIED ASPHALT — For penetration and surface treatment, per gal.:

Boston, applied	$0.12
Cincinnati, f.o.b. refinery	.06
New York, applied	.15
Pittsburgh f.o.b. refinery	.04@.06
St. Louis, applied	.12
Seattle, f.o.b. refinery	.055@.085

Iron and Steel

PIG IRON — Furnace, No. 2 foundry, per gross ton:

	Current	Mo. Ago	Yr. Ago
Birmingham	$11.00	$11.00	$12.00
Buffalo	16.00	16.00	17.00

	Pittsburgh	Chicago	Birmingham	Cleveland
STRUCTURAL SHAPES AND PLATES, per 100 lb., base, carload lots	**$1.60**	$1.70	$1.75	$1.78
CONCRETE REINFORCING BARS, ½ in., billet, per 100 lb., carload lots	**1.60**	1.65	1.75	1.50
SHEETS, per 100 lb., carload lots:				
Hot-rolled No. 10	1.55	1.65	**1.85**	.....
Hot-rolled annealed No. 24	2.20	2.30	2.35	.....
Galvanized No. 24	2.85	2.95	3.00	.....
TERNE PLATES, per package, I.C., 8-lb. coating, 20x28 in.	9.50	.....	.....	.....
RIVETS, per 100 lb., ½ in., structural, carload lots	2.25	2.35	2.70	2.25
SHEETPILING, per 100 lb., base, carload lots	1.90	2.05	.....	.....
WIRE NAILS, per 100 lb., base, carload lots	1.95	2.00	2.40	1.95
HEAVY MELTING STEEL SCRAP, No. 1, per gross ton, at consuming point	*8.75*	6.75	7.00	7.00

TRIANGLE MESH—Plain, per 100 sq.ft., 4 in. x 4 in., in carload lots:

Style Number	Weight in Pounds Per 100 Sq.Ft.	Pittsburgh Mill	Chicago District Mill
032	22	$0.94	$0.96
049	28	1.19	1.22
068	35	1.45	1.49
093	45	1.87	1.91
126	57	2.31	2.37
153	68	2.75	2.82
180	78	3.16	3.24
245	103	4.17	4.27
287	119	4.82	4.94
336	138	5.59	5.73
395	160	6.48	6.64
036P	17	.71	.7.
053P	24	1.01	1.03

TRIANGLE MESH—*Continued.*:

Style Number	Weight in Pounds Per 100 Sq.Ft.	Pittsburgh Mill	Chicago District Mill
072P	31	1.27	1.30
097P	40	1.64	1.68
049R	24	1.01	1.03
067R	31	1.27	1.30
089R	40	1.64	1.68

WIRE ROPE—Discounts from manufacturers' list prices on regular grades of bright and galvanized, Eastern Territory, New York, and East of Missouri River:

	Base
Cast steel round strand rope	25 %
Galvanized iron rigging and guy rope (add to list)	7½ %
Galvanized steel rigging and guy rope	12½ %
Plow steel round strand rope	40 %
"Special Steel" and extra strong cast steel, round strand rope	32½ %

Discount 5 points less than discount for Eastern territory: California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Texas, Washington and Wyoming. Discount 10 points less than discount for Eastern territory: Arizona, Idaho, Montana and Utah.

EXPANDED METAL LATH—Per 100 sq.yd., painted, f.o.b., in carload lots 2.2 lb. per sq.yd., standard-mesh diamond lath:

Atlanta	$20.00*	Los Angeles	$17.00
Birmingham	14.50	New Orleans	20.50
Boston	*15.50*	New York	13.50
Chicago	10.60	Pittsburgh	13.50
Cincinnati	11.00	St. Louis	17.00*
Dallas	16.50	San Francisco	17.00*
Detroit	18.00	Seattle	19.00
Kansas City	17.00		

*Delivered.

STEEL FREIGHT RATES — Per 100 lb., effective Dec. 3, 1931, on finished steel products in the Pittsburgh District, including plates, structural shapes, merchant-steel bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc.; 40,000 lb. per car:

Atlanta, 36,000 lb	$0.60	Detroit	$0.285
Baltimore	.29	Kansas City	.59
Birmingham	.60	New Orleans, 36,000 lb	.69
Boston	.42	New York, 36,000 lb	.35
Buffalo	.255	Pacific Coast, 60,000 lb	1.17*
Chicago	.36	Philadelphia	.31
Cincinnati	.285	St. Louis	.41
Cleveland	.205	St. Paul	.60
Denver	.92		

* All rail.

Railway Materials and Supplies

STEEL RAILS—Standard rails have been $43.00 per gross ton since Sept., 1922, at which time the price was $40.00; other rails, per gross ton, f.o.b., as follows:

	Pittsburgh	Birmingham	Chicago
Light rails	*$32.00*	$34.00	$34.00
Re-rolled rails	**28@30**	.....	27.00

RAILWAY TIES — Prices f.o.b., per tie, for carload lots:

		6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Boston	Oak, untreated	$1.00	.....
	Pine, untreated	*.90*	.....
	Pine, creosoted	*1.40*	.....
New York	Long-leaf sap pine, untreated	.90	$1.10
	Dense yellow pine, untreated	.65	.85
Birmingham	White oak, untreated	.90	1.05
	White oak, creosoted	1.45	1.55
	Southern pine, untreated	.45	.90
	Southern pine, creosoted	1.05	1.40
Chicago	White oak, untreated	1.05	1.35
	Oak, empty cell, creosoted	1.40	1.80
	Oak, zinc treated	1.25	1.65
	Southern pine, creosoted	1.15	1.50
Los Angeles	Fir, untreated	.47	.....
	Fir, creosoted	1.20	.....
St. Louis	White oak, untreated	**.75**	**1.25**
	Red oak, untreated	.70	*1.05*
	Red oak, creosoted	105	1.70
	Sap pine or cypress, untreated	**.60**	**1.00**
San Francisco	Douglas fir, green, untreated	.45	.65
	Douglas fir, empty cell, creosoted	1.19	1.62
Montreal	Birch or maple, untreated	1.00	1.00
	Birch or maple, creosoted	1.25	1.55

TRACK SUPPLIES — Prices per 100 lb., f.o.b., for carload lots:

	Pittsburgh	Birmingham	Chicago
Angle bars	$2.75	$2.75	$2.75
Standard spikes	2.60	2.60	2.60
Tie plates	1.85	1.85	1.85
Track bolts	3.50	3.50	3.50

Pipe

WROUGHT STEEL PIPE — Discounts from standard list for delivery from warehouse, except at Pittsburgh, where prices are f.o.b. mill. List prices per ft. as follows: 1-in., 17c.; 3-in., 76½c.; 3½-in., 92c.; 6-in., $1.92.

	1 to 3-In. Butt Weld		2½ to 6-In. Lap Weld	
	Black	Galvanized	Black	Galvanized
Atlanta	44%	36.5%	42%	34%
Boston	55.5%	42.25%	51.35%	40.1%
Chicago	57.25%	44.71%	53.83%	41.29%
Cleveland	53.3%	42.3%	50.8%	37.8%
Denver	44.5%	32%	41%	28.5%
New York	56.14%	43.6%	52.72%	40.18%
Pittsburgh	64%	52.5%	61%	49.5%
St. Louis	51%	38%	48%	35%

Current Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; decines by *italics*

Pipe—Continued

CAST-IRON PIPE — Prices per net ton, for bell and spigot pipe, Class B and heavier, f.o.b. in carload lots; gas pipe and Class A, $3.00 per ton extra:

	4-In.	6-In. and Over
Atlanta	.....	*$41.00*
Boston	*$38.00*	*35.00*
Birmingham	*32.00*	*29.00*
Burlington	*33.00*	*29.00*
Chicago	*37.40*	*33.40*
Dallas	*46.50*	*45.00*
Los Angeles	*38.00*	*35.00*
New York	*30.20*	*27.50*
Pittsburgh	*38.50*	*35.50*
St. Louis	*41.20*	*38.20*
San Francisco	*38.00*	*35.00*

SEWER PIPE—Prices delivered, per foot, for standard pipe; 6, 8 and 12-in. are single strength and 18, 24, 30 and 36-in. are double strength:

	6-In.	8-In.	12-In.	18-In.	24-In.	30-In.	36-In.
Atlanta	$0.125	$0.21	$0.385	.....	$1.40.	.....	.....
Baltimore	.10	.30	.58	.....	1.93	.....	$6.50
Birmingham	.18	.30	.54	$1.02	1.95	$3.50	5.00
Boston	.18	.28	.55	1.35	2.27	4.75	5.90
Chicago	.18	.28	.54	1.25	2.25	4.75	6.00
Cincinnati	.108	.21	.324	1.05	1.755	3.528	5.4325
Cleveland	.135	.21	.405	1.125	2.025	4.824	7.38
Dallas	.23	.325	.586	1.106	1.95	3.68	5.00
Denver	.16	.23	.414	.816	1.44	.....	.....
Detroit	.135	.21	.405	1.05	2.50	4.75	.....
Kansas City	.21	.335	.52	1.00	1.90	3.80	.....
Los Angeles	.2175	.2825	.5085	1.1865	2.034	3.69	.....
Minneapolis	.18	.23	.46	1.20	1.85	3.20	4.26
Montreal	.30	.45	.75	1.95	2.60	.....	7.20
New Orleans	.18	.30	.54	1.02	1.95	.....	.....
New York	.13	.21	.42	1.15	2.10	.....	.....
Philadelphia	.081	.126	.243	.65	1.17	2.376	4.615
Pittsburgh	.09	.18	.27	.62	1.22	2.45	3.68
St. Louis	.147	.235	.423	1.05	1.80	*3.00*	*3.80*
San Francisco	.175	.25	.45	1.05	1.80	3.00	4.50
Seattle	.22	.30	.54	1.26	2.16	2.50	5.50

CLAY DRAIN TILE—Per 1,000 lin.ft., f.o.b., in carload lots, 4 in.:

Atlanta	$50.00	Los Angeles	$60.00
Birmingham	50.00	New Orleans	40.00
Boston	*43.00*	New York	*33.00*
Chicago	40.00	Philadelphia	59.00
Dallas	65.00	Pittsburgh	80.00
Denver	75.00	St. Louis	40.00
Detroit	40.00	San Francisco (6-in.)	67.50
Kansas City	70.00	Seattle	60.00

Miscellaneous

LINSEED OIL—Raw, in 4-bbl. lots, per lb., f.o.b.:

Atlanta	$0.06	Minneapolis	*$0.066*
Birmingham	.08	Montreal	.54
Boston	*.075*	New York	*.064*
Dallas	.073	Seattle	.075
Denver	.0893	St Louis	.077
Kansas City (per gal.)	.54	San Francisco (del)	.1125
Los Angeles	.0866		

WHITE LEAD—In oil, per 100 lb. keg., f.o.b.:

Atlanta	$12.50	Los Angeles	$11.50
Birmingham	12.50	New Orleans	11.00
Boston	**14.00**	New York	12.00
Dallas	13.00	Seattle	11.00
Kansas City	*12.13*	St. Louis	12.00

Note: Both white and red lead, dry, same prices as foregoing; red in oil, $1.50 higher.

CHEMICALS—Water, sewage treatment, road work, f.o.b., carlots, New York:

Bleaching powder, in drums, f.o.b. works, per 100 lb.	$1.75
Calcium chloride, 77-80%, flaked, in 400-lb. drums, f.o.b. works, per ton	21.00
Chlorine, cylinders, per lb.	.04
Silicate of soda, in drums, f.o.b. works, per 100 lb.	1.35
Soda ash, 58%, in bags, per 100 lb.	1.15@1.17½
Sulphate of aluminum, in bags, per 100 lb.	1.25
Sulphate of copper, in bbl., per 100 lb.	2.75

MANILA ROPE—The number of feet per pound for the various sizes is as follows: ¾-in., 6-ft., 1-in.; ½-in., 4-ft., 5-in.; *1-in.*, 3-ft., 8-in.; *1½-in.*, 2-ft., 5-in.; *1½*-in., 1-ft., 8-in. Following prices are per lb. for ½-in. and larger, delivered in 1,200 ft. coils:

Atlanta	$0.184	Kansas City	**$0.25**
Baltimore	.225	Los Angeles	.1725
Birmingham	.20	Minneapolis	.175
Boston	*.17*	Montreal	*.1625*
Chicago	.175	New Orleans	.185
Cincinnati (f.o.b.)	.21	New York	.165
Cleveland	.21	Philadelphia	.15
Dallas	.25	St. Louis	.155
Denver	*.18½*	San Francisco	**.155**
Detroit	.185	Seattle	.175

BUILDING PAPER—Black, 50-lb. per roll of 500 sq.ft., in carloads, f.o.b., producing point *$1.80*

SLATERS FELT—In carloads, per roll, f.o.b., producing point **$0.65**

PREPARED ROOFING—Per square, f.o.b., in carload lots:

	Single Shingles*	Strip Shingles†	Rolls‡
Atlanta	$5.85	$6.25	$2.05
Boston	6.75	6.50	2.65
Dallas	5.25	4.50	2.25
Detroit	.....	.....	2.00
New Orleans	5.60	*5.50*	2.00
New York	6.50	6.25	2.50
Seattle	.....	6.60	2.55

*Slate finish, sufficient to cover 100 sq.ft.
†4 in 1, hexagonal shape, with Underwriters' label
‡Slate surfaced, in rolls weighing 85 to 90 lb.

ROOFING MATERIALS—In carload lots, f.o.b.:

	Asphalt Felt, per 100 Lb.	Tar Felt, per 100 Lb.	Asphalt Coating, per Gal.	Tar Pi... per T...
Atlanta	$44.50†	$44.50†	$0.45	$44.50
Boston	2.50	2.50	0.35	30.00
Dallas	3.25	3.50	1.00	42.00
Denver	2.00	2.00	.90	18.00
New Orleans	.....	2.50	.....	22.50
New York	2.40	2.40	.34½	28.00
Philadelphia	2.25	2.25	.35	22.00
Seattle	2.40	2.40	.55	27.00

*In 350 lb. barrels.
†Per ton.

WINDOW GLASS—Discounts from latest jobbers list, dated Sept. 15, 1928, for sizes above first three brackets:

	Single Thickness— A Quality	Single Thickness— B Quality	Double Thickness— A Quality	Double Thickness— B Quality
Atlanta	85%	85%	85%	85%
Birmingham	89%	91%	89%	91%
Boston	85%	90%	86%	90%
Dallas	85%	85%	87.5%	89.5%
Denver	84@5%	86@5%	84@5%	86@5%
Kansas City	91@5%	91@5%	90@5%	90@5%
New York	87%	89%	87%	89%
Philadelphia	88%	90%	88%	90%
Pittsburgh	87%	89%	87%	89%
Seattle	90@10%	90@20%	90@10%	90@20%

EXPLOSIVES—Price per pound for dynamite delivered:

	Gelatin 40%	Gelatin 60%		Gelatin 40%	Gelatin 60%
Atlanta	$0.215	$0.2375	Los Angeles	$0.1725	$0.1925
Baltimore	.21	.225	Minneapolis	.18	.195
Birmingham	.13	.1525	Montreal	*.1675*	*.1925*
Boston	.225	.25	New Orleans	.195	.22
Chicago	.17	.195	New York	.245	.2675
Cincinnati (f.o.b.)	.22	.245	Philadelphia	.215	.24
Dallas	.28	.30	St. Louis	.1975	.2175
Denver	.19*	.21*	San Francisco	.155	.18
Kansas City, Mo.	.2025	.2225	Seattle	.1525	.175

*F.o.b Louviers.

Lumber

LUMBER—Per M. ft., b.m., No. 1 Common, rough, in carload lots:

PINE

	1 x 6 In.* F.o.b.	1 x 6 In.* Del.	1 x 8 In.* F.o.b.	1 x 8 In.* Del.	3 x 12 In.† F.o.b.	3 x 12 In.† Del.
Atlanta	$14.00	.....	$15.00	.....	$35.00	*$45.00*
Baltimore	.....	$46.00	.....	.....	.....	70.00
Birmingham	.....	15.00	.....	$15.00	.....	18.00
Boston	*32.00*	*37.00*	*34.00*	*39.00*	*42.00*	*47.00*
Chicago	.....	.....	.....	.....	.....	62.50
Cincinnati	.....	28.00	.....	28.00	.....	35.00
Cleveland	.....	.....	.....	.....	.....	52.00
Dallas	.....	32.50	.....	32.50	.....	47.50
Denver	33.00	.....	33.00	.....	.....	.....
Detroit	29.00	29.00	30.00	30.00	32.00	32.00
Kansas City	21.00	.....	23.00	.....	28.00	52.00
Los Angeles	.....	.....	.....	.....	.....	.....
Minneapolis	.....	31.00	.....	31.00	.....	36.00
Montreal	45.00	.....	52.00	.....	67.00	.....
New Orleans	.....	15.50	.....	16.50	.....	52.00
New York	23.00	25.00	24.00	26.50	25.00	27.00
Pittsburgh	.....	**31.00**	.....	**31.00**	.....	**46.00**
St. Louis	23.00	28.00	24.50	29.50	47.00	52.00

FIR

	1 x 6 In.* F.o.b.	1 x 6 In.* Del.	1 x 8 In.* F.o.b.	1 x 8 In.* Del.	3 x 12 In.† F.o.b.	3 x 12 In.† Del.
Baltimore	.....	.....	.....	.....	.....	$46.00
Boston	*$28.00*	*$33.00*	*$30.00*	*$35.00*	*$33.00*	*38.00*
Chicago	.....	.....	.....	.....	.....	44.52
Cincinnati	.....	.....	.....	.....	.....	42.50
Cleveland	.....	.....	.....	.....	.....	52.00
Dallas	30.00	31.00	29.00	30.00	38.00	40.00
Denver	33.00	.....	33.00	.....	44.00	49.00
Detroit	.....	.....	.....	.....	30.00	30.00
Kansas City	.....	.....	.....	.....	31.50	39.00
Los Angeles	39.00	41.50	39.00	41.50	43.00	45.50
Minneapolis	.....	31.00	.....	31.00	36.00	40.00
New Orleans	.....	20.00	.....	20.00	.....	42.50
New York	22.50	24.50	23.00	25.00	25.00	27.00
Philadelphia	.....	.....	.....	.....	.....	28.00
Pittsburgh	.....	50.00	.....	30.00	.....	**58.00**
St. Louis	*30.00*	*35.00*	*30.00*	*35.00*	*34.00*	*39.00*
San Francisco	.....	.....	.....	*30.00*	.....	*32.00*
Seattle	10.00	11.00	10.00	11.00	14.00	15.00

*Form lumber, 16 ft. lengths. †Planks, 20 ft. lengths.

PILES—Prices of Nichols Bros., 90 West St., N.Y.C., per linear foot, pine, with bark on, f.o.b., New York; delivered from barge, 1½ to 2c. per ft. additional:

Dimensions	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.10	$0.155
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.14	.205
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.16	.225
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.195	.235
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.2125	.285
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	.275	.385
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	.315	.452

Engineering News-Record

A Consolidation of Engineering News, Engineering Record The Sanitary Engineer, and The Contractor

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